

**THE EFFECT OF DIETARY PATTERNS ON RISK FACTORS FOR
CHD: A COMPARATIVE STUDY OF STUDENTS RESIDING
AT THE ADVENTIST INTERNATIONAL INSTITUTE OF
ADVANCED STUDIES IN THE PHILIPPINES**

Thesis presented to the Department of Human Nutrition of the University of Stellenbosch in
partial fulfilment of the requirements for the degree of Master in Nutrition



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Degree of confidentiality : Grade A

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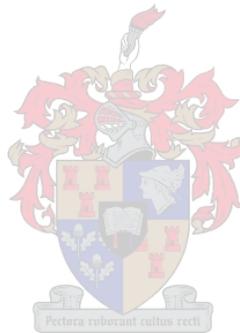
DECLARATION OF AUTHENTICITY

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously, in part or in its entirety, submitted it at any university for a degree.



Signature:

30 June 2006



ABSTRACT

OBJECTIVE: The primary aim of the study was to determine the nutritional status of vegetarian and non-vegetarian students in relation to their dietary preferences and risk factors (dietary, physical inactivity and obesity) for CHD.

DESIGN: Cross-sectional analytical study.

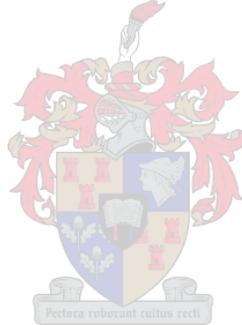
Setting: The Adventist International Institute of Advanced Studies (AIAS) situated in the province of Cavite, Philippines.

METHODS: The sampling frame was all graduate students at AIAS (n=203). Of these students 153 returned the distributed dietary questionnaires which determined dietary practices, thus yielding a stratified random sample of 70 registered students (≥ 20 y and ≤ 50 y) who met the inclusion criteria of the study. Three 24-hour recalls and a self-administered food frequency questionnaire assessed dietary practices. Lifestyle was assessed by means of questionnaires, which also included the socio-demographic characteristics of the subjects. Anthropometric measurements included height, weight and waist circumferences.

RESULTS: Seventy subjects participated in the study [non-vegetarian (n=38) and vegetarian (n=32)]. The mean age of subjects was 33.3 [(SD) 1.6] and 38.4 (1.9) years for non-vegetarian and vegetarian males respectively, with the respective means for females being 35.7 (2.0) and 33.2 (2.1) years. The majority of the vegetarians' income was insignificantly below \$10,000 as compared with that of non-vegetarians', in whom annual income earned was within the \$10,000-\$50,000 range per year. Variations in level of education between the dietary groups were small and inconsistent, most of whom were characterized by a high education level. Within this cohort, mean BMI and WC were insignificantly lower in the vegetarians when compared with the non-vegetarians. For males, the prevalence of overweight, pre-obese and obese ($p \geq 0.05$) for non-vegetarians was insignificantly higher than vegetarians. Insignificantly, female vegetarians were more pre-obese than non-vegetarians. As far as waist circumference was concerned, the prevalence of subjects observed in the alerting (≥ 94 cm) and action zone (≥ 102 cm) ($p \leq 0.05$) was 21% and 4% for non-vegetarian males, while 0% and 6% for vegetarian males. For females, more vegetarians were

insignificantly prevalent in the alerting zone ($\geq 80\text{cm}$) as compared to the non-vegetarians. Both dietary cohorts illustrated no considerable differences that exemplified moderate to a high level of physical activity. All subjects, regardless of dietary preference, were non-smokers and consumed no alcohol ($p > 0.05$). Overall, mean daily nutrient intake met current recommendations and there was no statistically significant difference between the two cohorts, except for fat and saturated fatty acids (SFA), which was higher among the non-vegetarians. Carbohydrate and fiber consumption was greater in the vegetarians. According to the DRIs, there were no intakes above the UL, however inadequate intakes of calcium and zinc posed possible risk of deficiency for both dietary groups.

CONCLUSIONS: A small percentage of subjects in both cohorts were at risk of CHD morbidity. Both groups followed good lifestyle habits with dietary choices being of greater concern among non-vegetarians.



OPSOMMING

DOEL: Die primêre doel van die studie was om die voedingstatus van vegetariër en nie-vegetariër studente met betrekking tot hul dieet voorkeure en risiko faktore vir koronêre hartsiekte (dieet, onaktiwiteit en vetsug) te bepaal.

NAVORSINGSONTWERP: Dwarssnit analitiese studie.

NAVORSINGS OMGEWING: Die Adventiste Internasionale Instituut vir Gevorderde Studies (AIAS) in die Provinsie van Cavite, Filippyne.

METODE: Die steekproef het bestaan uit alle gegradueerde studente van AIAS ($n = 203$). Slegs 153 van die studente het die dieet vraelys wat vir bepaling van dieet praktyke gesirkuleer is, teruggestuur. Die resultaat was 'n gestratifiseerde ewekansige monster van 70 registreerde studente (≥ 20 jaar en ≤ 50 jaar) wat aan die insluitings kriteria van die studie voldoen het. Drie 24-uur herroepe en 'n self-voltooid voedsel frekwensie vraelys is gebruik om dieetgewoontes te bepaal. Lewensstyl is deur middel van vraelyste bepaal, wat ook die sosio-demografiese eienskappe van die proefpersone ingesluit het. Antropometriese metings het ingesluit lengte, gewig en middelomtrek.

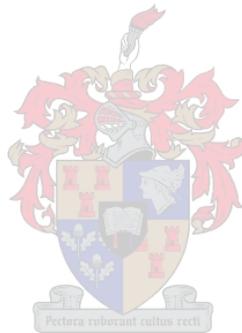
RESULTATE: Sewentig proefpersone het aan die navorsing deelgeneem (32 vegetariërs en 38 nie-vegetariërs). Die gemiddelde ouderdom van die proefpersone was 33.3 [(SD) 1.6] en 38.4 (1.9) jaar vir nie-vegetariër en vegetariër mans onderskeidelik, teenoor die gemiddelde ouderdom van 35.7 (2.0) en 33.2 (2.1) jaar vir die nie-vegetariër en vegetariër vroue onderskeidelik. Die meerderheid van die vegetariërs se jaarlikse inkomste was laer as \$10.000 in vergelyking met dié van die nie-vegetariërs wat gewissel het tussen \$10.000 - \$50.000 per jaar. Variasies in opvoedkundige vlak tussen die dieetgroepe was klein en wisselvallig, maar die meeste studente het 'n hoë opvoedkundige vlak gehad. In hierdie kohort was die gemiddelde liggaams massa indeks (LMI) en middelomtrek effens laer in die vegetariërs in vergelyking met die nie-vegetariërs (nie statisties betekenisvol). Vir mans was die prevalensie van oorgewig, pre-obesiteit en obesiteit nie betekenisvol hoër in nie-vegetariërs as in vegetariërs

nie ($p \geq 0.05$). Pre-obesiteit was effens meer algemeen onder vegetariese vroue in vergelyking met nie-vegetariese vroue (nie betekenisvol). Wat betref middelomtrek, was die aantal persone in die waarskuwing zone (≥ 94 cm) en die aksie zone (≥ 102 cm) 21% en 4% vir die nie-vegetariese mans, teenoor die 0% en 6% vir die vegetariese mans onderskeidelik ($p \leq 0.05$). In die geval van vroue het meer vegetariërs as nie-vegetariërs in die waarskuwing zone geval (≥ 80 cm) (nie betekenisvol). Die dieet groepe het geen beduidende verskille getoon met betrekking tot gemiddelde en hoë fisiese aktiwiteit nie. Alle proefpersone, ongeag hul dieetvoorkeure, was nie-rokers en het geen alkohol gebruik nie ($p > 0.05$). Oor die algemeen het die gemiddelde daaglikse nutriëntinname voldoen aan die huidige aanbevelings en daar was geen statisties betekenisvolle verskille tussen die twee groepe nie, met die uitsondering van vet en versadigde vetsure wat hoër in die nie-vegetariërs was. Inname van koolhidrate en vesel was hoër in vegetariërs. Volgens die DRIs was daar geen innames bo die UL nie, maar onvoldoende inname van kalsium en sink hou moontlike risikos in vir die ontwikkeling van 'n tekort in beide groepe.

GEVOLGTREKKING: 'n Klein persentasie van proefpersone in beide groepe het 'n risiko vir koronêre morbiditeit. Beide groepe handhaaf goeie lewensstyl gewoontes maar die dieet voorkeure van die nie-vegetariërs is 'n bron van kommer.

DEDICATION

For all those who pursue health and well-being. To those who will assess all the facts and apply it to their daily food choices made in the pursuit of disease prevention and in that way also improving and maintaining their health.



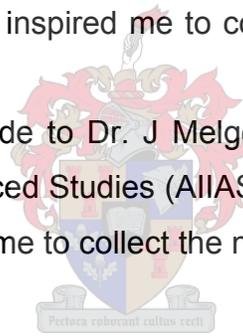
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My appreciation should be expressed to a number of people worth mentioning and who have my indebtedness for their aid in making this research possible.

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I would like to offer my gratitude to Dr. J Melgosa - president of the Adventist International Institute of Advanced Studies (AIAS) - and the AIAS Administrative Committee who had permitted me to collect the necessary data from the students at AIAS.



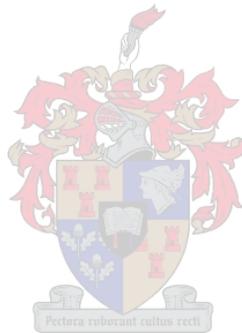
Special recognition goes to those very students who have been patient and helpful in consenting to provide the required data. I thank the Public Health students and Professor G Siapco. I would like to recognize Mr. TW Palm who had taken time to edit this paper as well as my parents-in-law who had helped with the Afrikaans abstract. I am also grateful to Prof. Herselman for her proficiency in translating the Afrikaans abstract.

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LIST OF ABBREVIATIONS

ADA	American Diabetes Association
AHA	American Heart Association
AI	Adequate intake
AIIAS	Adventist International Institute of Advanced Studies
ANOVA	Analysis of variance
BMI	Body mass index
BRFSS	Behavioral risk factor surveillance system
CHD	Coronary heart disease
CSA	Computer science applications
EAR	Estimated average requirement
EE	Energy expenditure
EER	Estimated energy requirement
FFQ	Food frequency questionnaire
FHCRC	Fred Hutchinson Cancer Research Center
FHSFFQ	Fred Hutchinson self-administered food frequency questionnaire
GSEL	Female and general population
HDL-C	High density lipoprotein cholesterol
HEPA	Health-enhancing physical activity
IPAQ	International physical activity questionnaire
LDL-C	Low density lipoprotein cholesterol
MET	Metabolic equivalent
MUFA	Monounsaturated fatty acids
n	number of population
NIH	National Institutes of Health
PUFA	Polyunsaturated fatty acids
SDA	Seventh Day Adventist
SELECT	Selenium and vitamin E cancer prevention trial

SFA	Saturated fatty acids
SFFQ	Self-administered food frequency questionnaire
TC	Total cholesterol
UL	Upper tolerable intake level
USA	United States of America
USDA	United States Department of Agriculture
VITAL	Vitamins and lifestyle study
WC	Waist circumference
WHO	World Health Organization



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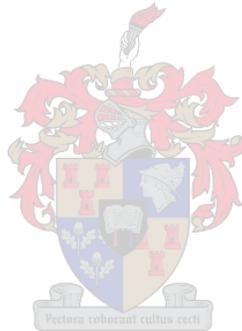
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CHAPTER 1 INTRODUCTION

1.1 NUTRITION ECOLOGY

1.1.1 Definition of Nutrition Ecology

Nutrition ecology is an interdisciplinary scientific discipline that incorporates the entire food chain as well as its interactions with health, the environment, society and economy in which a sustainable - “the development of fulfilling current global needs without diminishing the possibility of future generations to meet their own needs” - nutrition system could be achieved. It has been recommended that a food consumption pattern, which favors holistic and sustainable aspects on the nutrition ecology, should be encouraged.¹

There are three factors which influences food consumption patterns - economy; different population groups; influential individuals. Leitzmann in effect, elaborates by giving the appropriate approach for the influence of food consumption patterns - “It should be dominantly plant-based; originate from organic farming; produced regionally and seasonally; minimally processed; ecologically packaged; food trade should be fair.”¹

Ethically, dietary preferences should influence the “nutrition ecology” constructively with as few complications as possible. Consequently, the “holistic concept and sustainability” of the nutrition ecology will inevitably be attained.

1.2 FOOD CONSUMPTION PATTERNS

1.2.1 History

M. Messina and V. Messina, in “The Dietitian’s Guide to Vegetarian Diets”, states the inspiration of this diet pattern dates back to the 6th century when Pythagoras encouraged meatless diets amid his followers. In the 19th century, this diet became known as “vegetarianism” and was seen primarily in church movements.² One of their assertions was that in the 1930s certain deficiencies created a problem for governments. To remedy the problem, incentives were offered by governments as to increase production of animal products. Inclinations have changed since then and consumers are eating more fat, resulting in a drastic reduction of the recommended amount of carbohydrates and fiber to be consumed.³

Regardless of the modifications incited by governments and health officials, vegetarianism still exists. Unconventional speculations exist concerning this dietary practice and therefore reliable sources need to be scrutinized when making rational decisions relative to this diet. Judgments on any dietary practice for the matter at hand should be considered objectively and subjectively. Furthermore, allow the author to stress that every dietary practice has its vulnerabilities.

The World Health Organization (WHO) study group reported in 2003 that the growing epidemic of chronic disease is attributed to a change in dietary and lifestyle factors. Increases in fat, especially in saturated fat, and sugar have been observed. The increased consumption of fat predominantly consisted of animal sources. Therefore, a reduction in complex carbohydrates and dietary fiber found in fruit, vegetables and grains have been observed. This is clearly manifested in the China study which commenced in 1983 - one of the most rigorous studies at present - that non-communicable diseases are escalating contrasting to when their diet was more prevalent of vegetable sources and these diseases were not

significantly established.⁵ Substantial evidence such as the WHO report and the China study has proven that combinations of a deprived diet and reduced physical activity are precursors for risk factors for non-communicable chronic disease.^{4,5} The WHO resolved to find solutions as how to prevent this burden of non-communicable chronic diseases which is one of the most imperative issues as stated in one of their technical report series.⁴

1.2.2 Definitions of various vegetarian dietary patterns

A progeny of investigations and peer-reviewed publications on the topic of vegetarianism and its effects on health have captured the enthusiasm of scientific and professional minds, delving into the characteristics of this diet, which has taken the world by storm. However, before it can be objectively and subjectively appraised for its health benefits, risk for nutrient deficiencies need to be assessed and methods essentially supplied to prevent this at all costs. The fundamental pursuit should be to find equilibrium and prevent any discrepancies that can affect the holistic view and sustainability of the environment and life itself.

Fraser affirmed that dietary analyses have been predisposed to confounding and therefore creating difficulty in dealing with the complexity of this variable. Cognizant of this, he provides rectifiable methods by suggesting indispensable identification of food pattern characteristics, their actual dietary practices and the rationale for them.⁶ As a result of this deliberation, different patterns should be defined.

The term “vegetarianism”, covers all meatless diets, which can be further categorized as - Lacto vegetarian (milk and dairy are included in the plant-based diet); ovo vegetarian (only eggs are included); lacto-ovo vegetarian (both eggs and dairy are included); vegan (excludes animal flesh and animal products).³ There are more professed kinds of vegetarians - semi-vegetarians (predominantly practice a vegetarian diet, but occasionally eat chicken and fish;

Fruitarianism (A diet consisting of fresh fruits, dried fruits and selected vegetables);
 Macrobiotics (Special emphasis on a whole grain diet that also includes sea vegetables, legumes, and root vegetables with the occasional inclusion of fish).³

Epidemiological work has detected pertinent documentation pertaining to quantifiable benefits of vegetarian and other plant-based diets such as a reduction for the risk of many chronic degenerative diseases and total mortality.^{7,8,9,10,11} For example, in figure 1.1, low rates of obesity, coronary diseases, diabetes, many cancers, and increased longevity have been documented.⁷

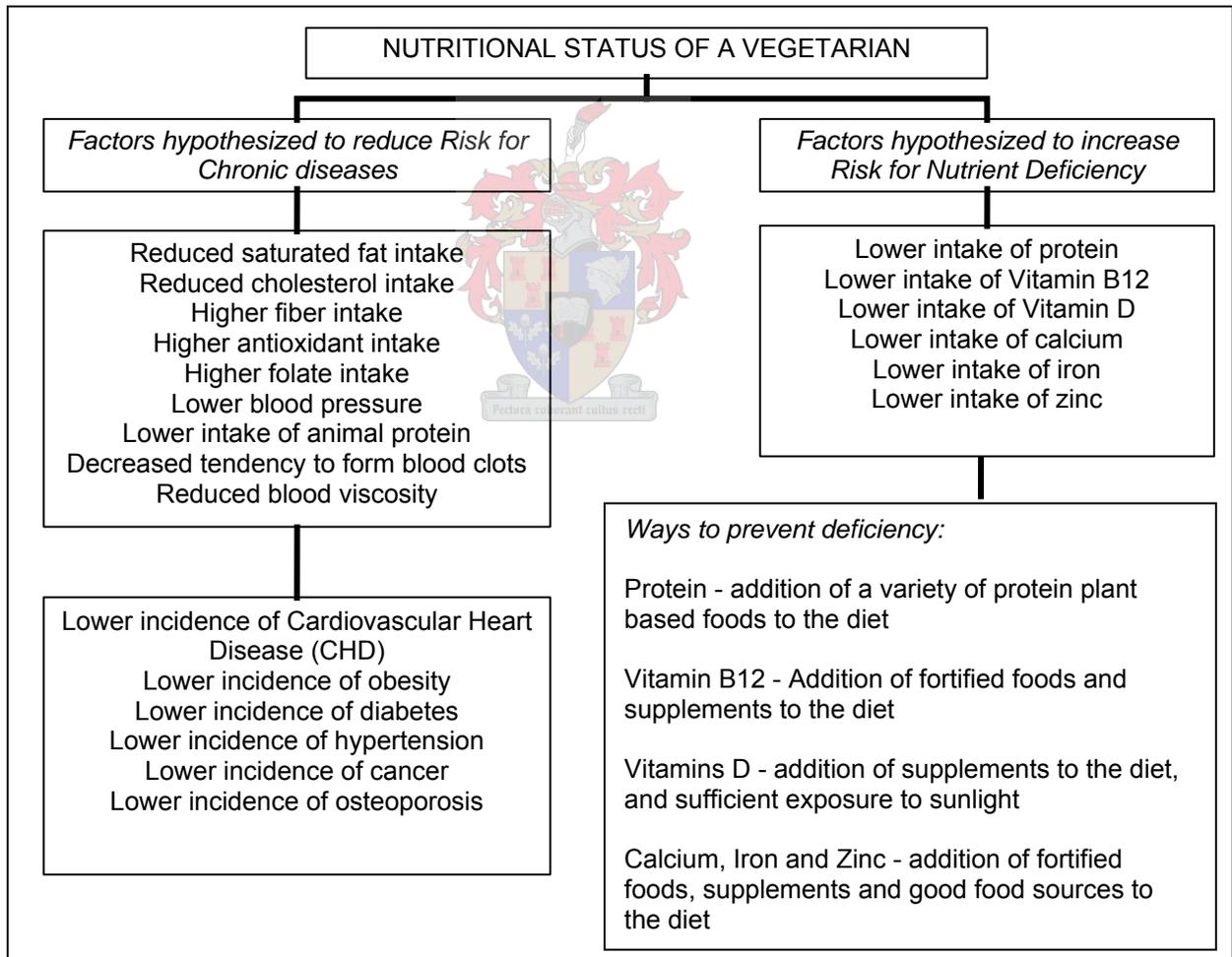


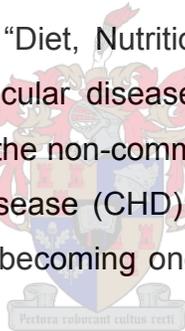
Figure 1.1: Diagrammatic representation of the nutritional status of vegetarians.^{7,12}

It seems that a vegetarian diet benefits populations through its preventative measures against chronic degenerative diseases and total mortality.^{9,12} Conversely, the deficiencies of some vital micronutrients have been noted as shown in figure 1.1. Responsibility should be practiced when adopting a vegetarian lifestyle, for example, pursuing to reduce the risk of deficiencies at hand. Thus, when individuals understand how to incorporate this significant dietary regime into their lifestyle, it becomes much simpler for them to follow and subsequently achieve the benefits thereof.

1.3 CORONARY HEART DISEASE

1.3.1 Statistical Data

A WHO technical report series, “Diet, Nutrition and the Prevention of Chronic Diseases”, states that cardiovascular diseases are a major contributor to the global burden of disease among the non-communicable diseases as represented in figure 1.1.⁴ Coronary heart disease (CHD) was responsible for a staggering “one-third of all global deaths” - becoming one of the major causes of mortality rates over the world.⁴



1.3.2 Established risk factors for CHD

As evidence of this, three established risk factors are associated with increased risk of CHD: high serum cholesterol and high body mass index (BMI) (both physiological characteristics) and physical inactivity (lifestyle characteristics).^{2,7}

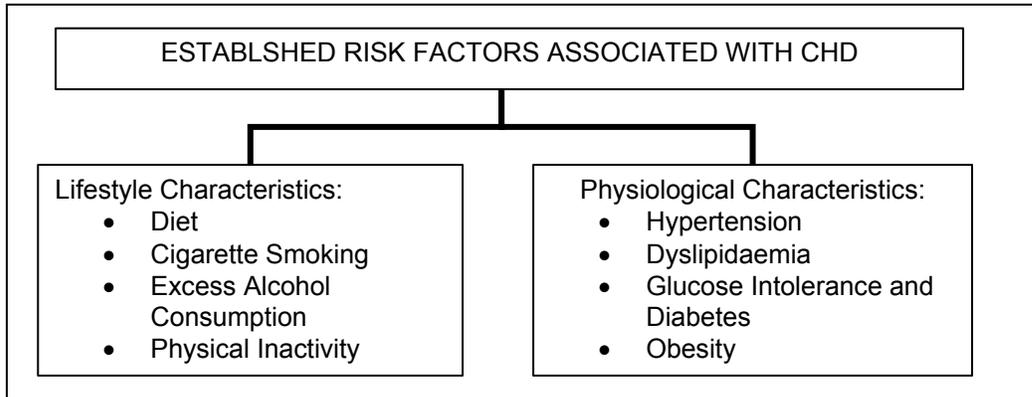


Figure 1.2: Diagrammatic representation of established risk factors associated with CHD.¹³

1.3.2.1 Dietary components raising blood cholesterol levels associated with increased risk of CHD

Factors which predispose an increment in total serum cholesterol levels resulting in an increased risk of CHD are total fat (raises total cholesterol levels), saturated fat (raises total cholesterol levels including low density lipoprotein cholesterol (LDL-C) levels), trans-fatty acids (raises LDL-C levels and decreases in high density lipoprotein (HDL) levels), and dietary cholesterol (raises total cholesterol and LDL-C levels). Accordant with these dispositions, subsequent increase in risk of CHD will ensue.⁷ The magnitude of quantitative and qualitative dietary fat introduced in the diet can be observed by the total serum cholesterol levels.^{11,14,15,16} LDL and HDL cholesterol levels are exemplary sources of augmenting the total serum cholesterol levels and diminishing the total serum cholesterol levels respectively.

In a preliminary report of Californian Seventh Day Adventist (SDA) groups, CHD mortality rates were significantly lower in vegetarians than in non-vegetarians. Their data suggested that vegetarianism might have a significant influence on the risk of CHD deaths among males.¹⁵ In view of the fact that the study population are SDAs who do not conform to other risk factors, smoking and alcohol intake *per se*, it could be stressed that this conformity also attributes to the significant

repercussions. The Oxford Study determined to obtain the same effect if the vegetarian diet was certainly responsible for the lowering effects of mortality. Thus the study set out to assess other vegetarians not belonging to a particular religious group. For example, the SDA group's lifestyle habits (almost always non-smokers and non-alcoholics) apart from the diet could have been a contributing factor to the lower death rates. Considerably this study also had a reduction in mortality from ischemic disease in vegetarians independent of healthy lifestyle habits.¹¹

In five prospective studies, comparisons of mortality between western vegetarians and non-vegetarians with similar lifestyles were "collaborated". It was stated that lower mortality among the subgroups were attributed to the dietary differences.^{10,14} The Health Food Shoppers Study, Oxford Vegetarian Study and Heidelberg Study communicated significant data. Vegetarian participants showed lower total serum cholesterol concentrations than their counterparts - 0.61 mmol/L, 0.43 mmol/L and 0.33 mmol/L respectively. This evidence anticipates a difference of 27% reduction in mortality rates from CHD when there is a decrease of 0.6 mmol/L of total serum cholesterol levels.¹⁰



Appleby et al. critically states that the "hypocholesterolemic effect" can be the factor resulting in the reduction in CHD. This effect is probably due to the consumption of less saturated fat and cholesterol found in animal products and an increase in higher fiber content found in fruit, vegetables and grains causing the lower serum cholesterol levels.¹¹ The Oxford Vegetarian Study's objective was to compare plasma lipid concentrations among certain dietary groups. The pooled groups were compared (vegans, meat-eaters, vegetarians, fish eaters); it was found that both total and LDL-cholesterol concentrations were significantly lower in vegans, intermediate in vegetarians and fish eaters; compared to the meat-eaters. A total exclusion of meat from the diet would probably result in a 15%-25% reduction in ischemic heart disease.¹¹

Independent of other lifestyle factors - smoking and alcohol intake - influencing CHD mortality, the point worth mentioning here is that diet plays an irrefutable role in ascertaining total serum cholesterol levels. Reviewing the Californian Seventh Day Adventist study and the Oxford study, one can conclude that the diet indeed influences the total serum cholesterol levels to an evident extent independent of the additional lifestyle factors. These levels are primarily influenced by the LDL levels, which could probably influence the mortality rates in vegetarians and non-vegetarians.^{11,15}

1.3.2.2 High BMI levels associated with increased risk of CHD

BMI measurements - a medical standard used to define obesity - can help determine obesity in individuals. Obesity is one of the main risk factors for developing CHD. Additional precursors associated with this condition are hypertension, diabetes and cancer. Distribution of weight is an important determinant of obesity-associated morbidity; preponderance of weight in the abdominal area is another accurate measure, known as the apple shape where the waist circumferences (WC) measurement is taken. It represents a health risk for overall mortality, heart disease, cancer, diabetes, and hypertension.^{17,18,19,20} WC should be used in conjunction with BMI to obtain enhanced predictions for the reason that BMI cannot differentiate whether the overweight is the result of muscle, bone, water or fat.¹⁸

During a 1998 International Conference on obesity, WHO identified obesity as a worldwide epidemic, claiming that obesity was one of the top five global health problems in industrialized and developing countries. In 1995, there were an estimated 200 million obese adults worldwide. As of 2000, the number of obese adults has increased to over 300 million.²⁰

Table 1.1 represents four large epidemiological studies, which summarizes BMI data that clearly proposes that meatless diets are associated with lower overall BMI scores and a low prevalence of obesity in adults.¹⁰ The Adventist Health

Study meticulously evaluated the effects of a vegetarian diet compared to non-vegetarians on obesity. Socio-demographic and lifestyle characteristics were similar, however the dietary patterns differed significantly. Some 34,000 individuals' diets and lifestyle characteristics were followed for several years and the incidence of chronic disease and death were documented. The prevalence of obesity between vegetarians and non-vegetarians were significantly different.⁷

A low BMI was depicted in the vegetarian cohort who was compared with a strikingly different representation by the non-vegetarian cohort. The average BMI of the two groups were in close proximity. The BMI representation demonstrates that the vegetarian group lies within the recommended BMI measurements. Diagrams representing this analogy have been printed in the "Vegetarian Nutrition".⁷ Vegetarianism seems to influence the BMI in a beneficial way, an indicator for obesity, which is a risk factor for CHD. Conversely, through evaluation of the BMI one needs to be cautious since it could over- or underestimate obesity. Thus, WC becomes indispensable which could also be used in conjunction with the BMI to make profitable postulations when dealing with obesity and its assessment in individuals.

Table 1.1: Tabulation of large epidemiological studies with observed BMI values.⁹

Epidemiological studies	Vegetarian n (BMI [kg/m ²])		Non-vegetarian n (BMI [kg/m ²])	
	Male	Female	Male	Female
Adventist Mortality*	3 971 (24.6)	6 287 (24.0)	5 023 (25.7)	9 257 (25.1)
Adventist Health Study*	3 169 (23.8)	4 834 (23.0)	9 045 (25.4)	904 (24.8)
Oxford England	1 603 (22.0)	3 071 (21.3)	2 572 (23.0)	3 801 (22.1)
Heidelberg Germany	480 (21.3)	603 (20.9)	304 (22.1)	370 (21.3)

* United States of America (USA)

1.3.2.3 Physical inactivity associated with increased risk of CHD

Physical inactivity is positively associated with CHD risk. When engaged in activity it lowers the risk of CHD and also other related diseases. Physical activity is related to a copious of health benefits as listed on a well-known website, American Heart Association (AHA).^{9,21,22,23} With relevance to this review a few

will be mentioned - "It reduces the risk of heart disease by improving blood circulation throughout the body, it keeps weight under control and it improves blood cholesterol levels".²²

Given that physical activity is an important contributor to the weight of an individual, it may assist in the reduction of weight gain, and the prevention of obesity. The essential recommendation is to exercise for 30 minutes a day at a moderate-intensity.²³ This is found to be sufficient to offer preventive measures on most, if not all, cardiovascular and metabolic diseases. A number of epidemiological studies prove that a smaller risk of weight gain, overweight and obesity is present among persons who currently engage regularly in moderate to large amounts of physical activity.²³

1.4 THE PARADIGM SHIFT

1.4.1 Definition and explanation of the Paradigm shift

It was established through a paradigm shift - when one conceptual world view is replaced with another - where a progression of the models epitomizes the evolution of scientific understanding on the overall effects of these dietary patterns on human health that well-balanced plant-based diets are viewed more as improving health than causing disease.⁸ The basic concept of the first model was that a population following a vegetarian diet was at higher risk for developing nutrient deficiency diseases than a population following a meat-based diet.

However, it should probably be acknowledged, according to the author, that a cultural bias against meatless diets possibly contributed to publications about and increased awareness of the potential health risks of vegetarian diets. Much of this bias resulted from scientists who were performing the research. They could have probably not resisted this cultural bias because most of those paying for the research were mainly composed of non-vegetarians.⁸

The second model introduced that diets, meat and meatless diets had extremes on either side of the paradigm, excess and deficient intakes respectively. It proposed that no overall improvements could be accomplished because if the curves were displaced, the same amount gained at one end would inevitably be lost at the other end.

The last model in figure 1.3 represents a paragon in the center of the diagram where the relative contribution to the causation and prevention of disease for excess and deficiency is clearly unequal for the 2 contradictive diets, with a more favorable risk-to-benefit ratio for the well-balanced vegetarian diet.⁸

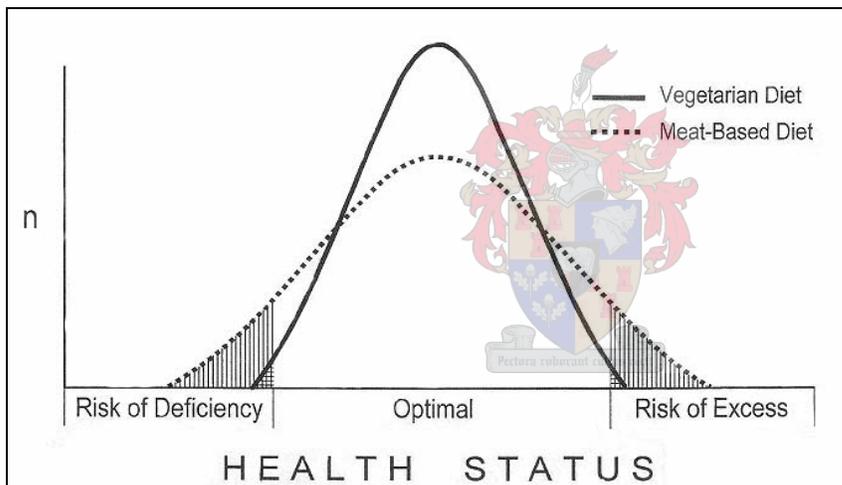


Figure 1.3: Diagrammatic representation of the optimal diet.⁸

From: Sabate J. The contribution of vegetarian diets to health and disease: a paradigm shift? *Am J of Clin Nutr* 2003; 78(suppl): 502S-7S.

1.5 CONCLUSION

Scrutinizing epidemiological studies, it is observed that there is an influence in shifts between these two contradictory dietary patterns. Inclination toward either side would result in an aversion for either dietary pattern. Evidence of this is seen

in numerous published articles on this issue. The purpose of this paper is not to establish prejudice against omnivorous practice, on the contrary it merely sets out to obtain, if any, benefits from subsequent vegetarian practice and how this can aid in the prevention of CHD and eventual mortality. Individuals are entitled to their own views concerning their consumption patterns, and it should be adept in relation to the individual's discretion about the facts. Moreover, when truth is misplaced or even displaced, facts can be obscured.

When evaluating the advantages and disadvantages of each pattern, the effects it would have on the overall health status of an individual should be considered. It is assumed that no other study has been performed on a multicultural group of participants (Africans, South Americans, South Pacific islanders and Asians) living in the Philippines, therefore standardized measures will be implemented to execute this study and to compare these two diets, namely vegetarian and non-vegetarian.

Hence a study was conducted to weigh the advantages and disadvantages of these two opposing dietary patterns on either side of the paradigm in a multicultural group of students residing at the Adventist International Institute of Advanced Studies (AIAS), Lalaan 1, Silang, Cavite, Philippines. Dietary, lifestyle factors and anthropometric assessments were implemented. This report will attempt to help students living at AIAS to make better decisions regarding their dietary and lifestyle choices to prevent non-communicable diseases, explicitly CHD.

CHAPTER 2: METHODOLOGY

2.1 STUDY AIMS

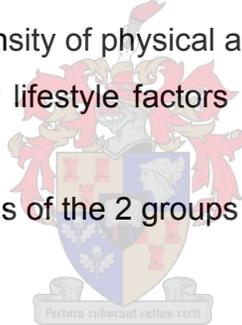
Aim:

The primary aim of this investigation was to determine the nutritional status and the presence of risk factors (dietary, physical inactivity and obesity) for CHD among vegetarian and non-vegetarian graduate students living in the Philippines and studying at Allias.

Objectives:

The objectives of the study were to determine and compare:

- The dietary patterns of vegetarians and non-vegetarians
- The prevalence of overweight and obesity in the 2 groups
- The prevalence and intensity of physical activity in the 2 groups
- The prevalence of other lifestyle factors (smoking and alcohol intake) in the 2 groups
- The socioeconomic status of the 2 groups



2.2 STUDY DESIGN

2.2.1 Study type

A cross-sectional, comparative (non-vegetarian and vegetarian), analytical study was conducted to determine the nutritional status of a heterogeneous cohort of students residing at Allias during a specific period (April 2005 – July 2005).

2.2.2 Study population

A multicultural group of registered students who were studying at Allias in the Philippines were selected for the investigation. Generally, students attending this Institute come from Asian, African, South Pacific and South American countries.

Thus the usual profile as mentioned above represented the cohort from which a sample was drawn.

2.3 SAMPLING

2.3.1 Selection criteria

An established dietary pattern was essential and the subjects' level of English comprehension had to be intermediate or advanced for eligibility to participate. The required age range for participants was from 20-50 years. Pregnant and lactating women were excluded from the study. Subjects who met these selection criteria and who were willing to participate in all procedures were included in the investigation.

2.3.2 Sampling method

The AIIAS had a total of 203 students in its register at the time of the study. For evaluation of their habitual food preferences, all students were approached and asked to complete a questionnaire (Appendix 2). The number of subjects included in the study according to their dietary practices as obtained from the survey was one hundred and fifty three students (response rate = 75%) who responded to the circulated questionnaire (Table 2.1). Based on the information received, subjects were categorized into three dietary groups that were selected for randomization to participate in the main study, namely the non-vegetarians (n = 91), semi-vegetarians (n = 29) and lacto-ovo vegetarians (n = 18). The remainder subjects (n = 15), who were excluded from the sampling frame, consisted of the vegans (n = 2), unknown (n = 3) categories and subjects who were included in the pilot study (n = 10). The "semi"¹ and "lacto-ovo" vegetarians were combined to represent the vegetarian cohort due to the insufficient number of lacto-ovo vegetarians that was initially the selected group for the cohort. Thus, a sampling frame (n = 138) was formed from which the two cohorts (non-

¹ Semi-vegetarian - those who include both fish and chicken in their diet

vegetarian [n = 91] and vegetarian [n = 47]) were randomized. The randomization program used was found on the web site Randomization.com (<http://www.randomization.com>).²⁴ Hence a stratified sampling method was administered via computer randomization that obtained two sub samples [non-vegetarian (n = 38) and vegetarian groups (n = 32); (total n = 70)] to accomplish the objectives of the study. According to the estimated sample size proportion provided by a statistician (Prof.DG Nel), the sample size should have included the entire population (n = 203) at AllAS. However, there were only 153 who responded. For practical reasons such as the response, logistics, instruments and the budget, only fifty percent of the total eligible sample in each group was selected for inclusion in the main study. Students who fulfilled the selection criteria (n = 70) were eligible and participated in the procedures of the investigation from April 2005 to July 2005.

Table 2.1: Tabulation of dietary patterns of the number (%) of subjects who responded and randomized for the study.

Dietary patterns	No. of subjects [n (%)] who responded to the questionnaire and were randomized to participate in the pilot study	No. of subjects [n (%)] who were randomized to participate in the main study	No. of subjects [n (%)] who were randomized and included in the main study
Non-vegetarians	98 (64%)	91 (66%)	38 (51%)
Semi-vegetarians	32 (20%)	29 (21%)	18 (24%)
Lacto-ovo vegetarians	18 (11%)	18 (13%)	18 (24%)
Vegan	2 (1%)	0 (0%)	0 (0%)
Unknown*	3 (2%)	0 (0%)	0 (0%)
TOTAL	153 (100%)	138 (100%)	74**

* The “unknown” category did not complete the whole dietary survey thus unable to categorize the subjects into dietary practices

** Four subjects (semi-vegetarians [n=4]) were excluded because of poor compliance; the total number of subjects included in the study were 70.

2.4 DATA COLLECTION

2.4.1 Logistics

The investigator collected dietary and lifestyle data by means of standardized questionnaire-based procedures and interviews (Figure 2.1). Anthropometric

data was obtained with the assistance of a group (n = 4) of post-graduate public health students at AIIAS, who did not participate in the study, using standardized techniques and standard equipment. The group of assistants was first trained thoroughly to use the instruments by means of correct procedures (requirements carried out according to the revised WHO recommendations).¹⁷ The students residing at AIIAS were then invited to come and have their anthropometric measurements taken by the trained group of assistants. This was achieved by close observation to ensure consistency and accuracy of observer's measurements by an associate professor in nutrition at AIIAS (Dr.G.Siapco)¹ and by the investigator. Thereafter, during the pilot study (refer to 2.7 for further details), 10 subjects were randomly selected from the 153 returned surveys (these subjects were excluded from the main study)

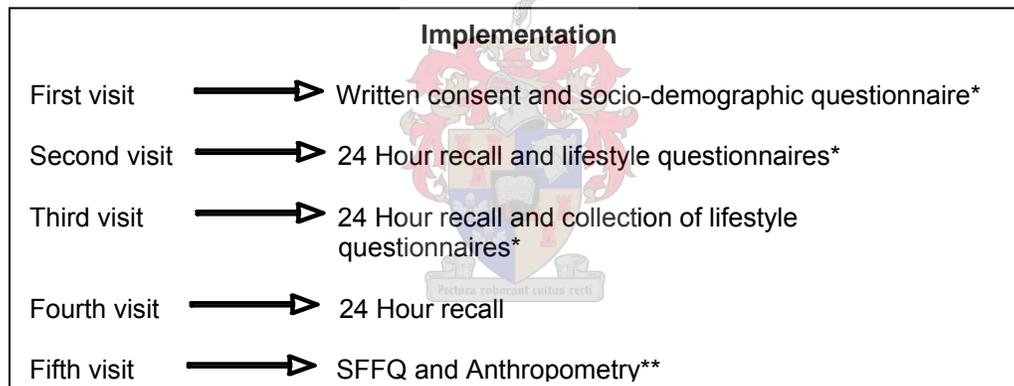


Figure 2.1: Diagrammatic representation of the implementation of the study.

* Returned questionnaires were checked for completeness; if there were any queries the investigator made sure to clarify them.

** Self-administered food frequency questionnaire (SFFQ)

¹ Dr.G.Siapco (PH, Loma Linda University, 2004. MPH, AIIAS, 1998. BS, University of the Philippines, 1982)

2.4.2 Instruments

2.4.2.1 Socio-demographic variables

A socio-demographic questionnaire (Appendix 3) and the 2001 Behavioral Risk Factor Surveillance System (BRFSS)²⁵ was given to each individual at the first visit after they had consented and signed the consent form. Upon handing out of the socio-demographic questionnaires, the questionnaires were accompanied by a comprehensive explanation on how to complete them. If any of the subjects still had any other queries regarding this questionnaire, they were able to contact the investigator telephonically by the telephone number provided on the consent form. This questionnaire included information on gender, age, ethnicity as well as marital and socioeconomic status.

2.4.2.2 Anthropometry

Consecutively, three quantitative measurements (weight, height and waist circumference) were taken at the same time of the day - during the morning - and recorded on an anthropometric sheet (Appendix 4). The subjects wore light clothing without shoes and other accessories that would have affected the measurements with an empty bladder. To enhance reliability, an average of the three successive measurements were taken as the final measurement.^{17,26,27}

Weight and height were measured and used to calculate the BMI (kg/m^2) of the individual. A digital scale and stadiometer was used to measure the weight to the nearest 0.1kg and height to the nearest 0.1cm respectively. The scale used was a health o meter ® manufactured by 2004 Sunbeam Products, Inc. Boca Raton, in the USA Florida 33431. The electronic scale had a micro-computer chip so that it could adjust to zero and weigh people quickly and accurately. The stadiometer was manufactured by Seca in America. Subjects stood in the Frankfort position with the heels, buttocks, scapulae and the back of the head touching the back of the vertical board of the stadiometer when height was recorded.^{17,26,27}

Waist circumference (WC) was measured to the nearest 0.1 cm at the narrowest area below the rib cage and above the umbilicus as viewed from the front. If there was no apparent area of least circumference, the measurement had to be taken at the level of the umbilicus. Subjects stood erectly with feet 25-30cm apart with shirt lifted. The abdominal muscles and arms were relaxed at the side while the measurement was taken below the rib cage and above the umbilicus at the end of normal expiration. An inelastic, flexible tape that was manufactured by Gulick, in America, was used to take the measurement.^{17,26,27}

2.4.2.3 Dietary and nutrient intake

To assess the dietary intake, the choice of method and validity thereof was pivotal in order to achieve the objective of the study. The choice of a valid dietary intake method is a difficult one and thus the investigator set out to assess the face validity.^{27,28} Due to the simplicity and feasibility of administering the 24-hour recall, multiple 24-hour recalls were implemented in conjunction with the FFQ to obtain the nutrient intake results for the purpose of this study.²⁸

For the purpose of the 24-hour recall (Appendix 5), three face-to-face interviews were performed on all foods eaten and liquids drank during the previous day, a 24-hour period. Three non-consecutive days were assigned through the randomization technique for participants to be visited at their homes. The days of the week were given numbers and all the respondents were given I.D numbers. The computer program randomly selected the given numbers (or days). On those specific days, the computer randomly selected from the list of given I.D numbers (or respondents). Subsequently, 2-week days and 1 weekend day for each participant were designated for home visitation. The exact day was unknown to the respondents and investigator.

A booklet containing pictures and portion sizes of foods was used to guide the respondents to estimate the quantities of the foods and beverages consumed.

This booklet is obtainable on the Fred Hutchinson Cancer Research Center's (FHCRC) website.²⁹ Each session lasted for 20-30 minutes in order to get as accurate description of foods and portion sizes as possible and clarification of information was made at the end of the session.

The habitual dietary intake for the past year was recorded using validated SFFQ booklets (Appendix 6) accessible from the FHCRC website.²⁷ The self-administered quantitative food frequency questionnaire aimed to comprise the whole diet. The booklet used to guide the respondents to estimate the quantities of the foods and beverages consumed for the 24-hour recall was also used to estimate portion sizes when completing the SFFQ.

This questionnaire has previously been validated by a randomized, controlled trial of a worksite-based intervention, the Seattle 5 A Day Worksite Project, which entailed the completion of 3 24-hour recalls and had a Pearson correlation of 0.50 for total fruit and vegetable groups. A Women's Health Trial Feasibility Study in Minority Populations, a randomized trial, testing the effectiveness of a low-fat dietary intervention program, which entailed the completion of both a 100-item FFQ and a 4-day food record and had Pearson correlations of 0.41 and 0.36 for the FFQ and food record respectively. The correlations between nutrient intake measured by FFQ and food records for the whole group was % of energy from fat (0.74), total fat (0.50), % of energy from carbohydrates (0.59), total carbohydrates (0.43), protein (0.53), total protein (0.27) and energy intake (0.32). It is based on the questionnaires used in 2 large National Institutes of Health (NIH) funded studies, specifically the Selenium and Vitamin E Cancer Prevention Trial (SELECT) and VITamins and Lifestyle Study (VITAL).^{30,31,32,33,34} The questionnaire was accepted as validated since it was tested in randomized trials as mentioned previously. The validity of this questionnaire for the purpose of this study was also accepted because the subjects of those studies and the subjects participating in this study were of similar descent. Relative validity was also assessed using the 24-hour recall method.

Before these questionnaires were given to the participants, the investigator had to assure quality by checking for any mistakes and errors, which should not have appeared on the questionnaires. She also had to make sure that all questions were answered clearly using a pencil.

2.4.2.4 Physical activity

The physical activity status was assessed by using the International Physical Activity questionnaire (IPAQ) (Appendix 7). The development of this instrument (questionnaire) commenced in Geneva 1998 in order to obtain an international measure for physical activity.³⁵ It was extensively tested for reliability and validity across 12 countries during the year 2000. Test-retest repeatability was conducted within the same week and the criterion validity of the IPAQ against the Computer Science Applications (CSA; now called MTI) accelerometer were assessed.³⁶ Spearman's correlation clustered around 0.8 while the criterion validity had a median of about 0.3.

After the protocol was accepted, the investigator decided that it would be more feasible and practical to use the short questionnaire (7 questions) rather than the long questionnaire (27 questions), which had been previously chosen. The main reason for this approach was that there were so many questions in the long questionnaire, which were not applicable, and upon meeting with students, it was observed that they were too busy to fill in lengthy questionnaires. Therefore to avoid bias regarding the questions and unused information, it was decided to use the short form, which focused on the activities relevant to this population.

The short form (4 generic items) was used which has 7 questions covering the activities related to work, house and yard related activities, transport, recreation, exercise or sport. The frequency, intensity and time spent during the physical activity in the last 7 days were assessed.

2.4.2.5 Tobacco use

A 1-page short questionnaire (Appendix 8), 2001 Behavioral Risk Factor Surveillance System (BRFSS), was used to determine smoking status. The BRFSS tobacco questionnaire consists of 6 questions related to smoking.²⁶ Subjects were asked whether they had ever smoked or not. If they had smoked, they were to continue to the rest of the questions, which expounded on the age started, how many cigarettes smoked, and if they were smoking at the present time. Those who had quit smoking were also questioned on how long they had ceased smoking.

2.5 DATA ANALYSIS

2.5.1 Anthropometry

The BMI measurements were used to classify subjects according to the WHO classification in order to obtain the prevalence of subjects in each category.^{17,18,19} Due to the body mass differences among the various ethnic groups, especially for Asians and Pacific Islanders, it was decided to obtain particular cut-off points for these groups.³⁷ A tabulation of BMI and waist circumference by ethnicity and cut-off points (proposed cut-off points from the “The Asia-Pacific perspective”) were used to classify the subjects in conjunction with the WHO cut-off points mentioned in the protocol (Table 2.2).^{17,18,19,37}

Table 2.2: Tabulation of BMI and waist circumferences by ethnicity and cut-off points. ^{17,18,19,37}

Ethnic groups	BMI (kg/m ²)	Classification	Waist circumference (cm)		Classification
			Male	Female	
White, Black and other	16-16,9	Grade 2 CED	≥ 94	≥ 80	Level 1
	17-18,5	Grade 1 CED			
	18,5-24,9	Normal			
	≥ 25	Overweight	≥ 102	≥ 88	Level 2
Asian	25-29,9	Pre-obese			
	< 18,5	Underweight	≥ 90	≥ 80	Level 1
	18,5-22,9	Normal			
	≥ 23	Overweight	≥ 102	≥ 88	Level 2
Pacific Islander	23-24,9	Pre-obese			
	25-29,9	Obese			
	< 18,5	Underweight	≥ 90	≥ 80	Level 1
	18,5-24,9	Normal			
	>25	Overweight	≥ 102	≥ 88	Level 2
	≥ 32	Obese			

* Chronic energy deficiency (CED)

2.5.2 Dietary and nutrient Intake

The United States Department of Agriculture (USDA) standard was used for the analysis of three 24-hour recalls and the SFFQ to determine the usual intakes of food consumption for dietary patterns of subjects that were classified into vegetarian and non-vegetarian groups. The investigator who used the nutritional software package analyzed the 24-hour recall dietary data whereas the FHRCR analyzed the SFFQ dietary data.

2.5.2.1 24-Hour recall

The dietary variables of the 24-hour recalls were used in conjunction with the SFFQ in order to obtain the average of the two methods.

Food intake data was analyzed with a nutritional diet analysis program, Optimal Nutrition. The Optimal Nutrition software analyzes 30 nutrients in the participant's diet. It incorporates the September 2002 guidelines issued by the Institute of Medicine, the medical division of the US National Academies.³⁸ Major nutrients assessed by the 24-hour recall - Major Nutrients - Energy (kcal); total fat (gm);

saturated fat (gm), monounsaturated fatty acids (gm), polyunsaturated fatty acids (gm), protein (gm); carbohydrates (gm); alcohol (gm); cholesterol (gm); fiber (gm); Vitamin B12 (gm), Calcium (gm), Iron (gm) and Zinc (gm).

The results was compared with the Dietary Reference Intakes (DRIs).³⁹ The number of individuals consuming nutrients below the estimated average requirement (EAR)¹ and above the upper tolerable intake level (UL)² were determined. Adequate intake (AI)³ was used to compare the mean intakes of the two dietary groups. In order to determine whether the subjects from the two groups consumed acceptable distribution ranges for energy, carbohydrate, protein and fat intakes, the acceptable macronutrient distribution ranges (AMDR) was used.⁴⁰

2.5.2.2 Fred Hutchinson self-administered food frequency questionnaire (FHSFFQ)

The questionnaire was analyzed by the FHRCC via optical scanning.²⁶ For every completed batch of files, food consumption data, nutrient intake data, and an error report that specifies questionnaire completion errors was provided. These error reports served as the quality assurance check (Appendix 9). Furthermore, the relative validity of this questionnaire was also assessed by three non-consecutive 24-hour recalls, which was carried out in the beginning stages of the study. Major nutrients assessed by the FHSFFQ included energy (kcal); total fat (gm); saturated fat (gm), monounsaturated fatty acids (gm), polyunsaturated fatty acids (gm), protein (gm); carbohydrates (gm); alcohol (gm); cholesterol (gm); fiber (gm); vitamin B12 (gm), vitamin D (gm), calcium (gm), iron (gm) and zinc (gm). The amount of fruit and vegetables (servings) were also determined. The results were also compared with the DRIs.³⁹

¹ the intake that meets the estimated nutrient need of 50 percent of the individuals in that group

² the maximum intake by an individual that is unlikely to pose risks of adverse health effects in almost all (97 to 98 percent) individuals

³ average observed or experimentally derived intake by a defined population or subgroup that appears to sustain a defined nutritionally state, such as normal circulating nutrient values, growth, or other functional indicators of health

2.5.3 Physical Activity

The metabolic equivalent (MET) level was used to measure physical activity intensity and 3 category intensities were characterized: inactive, minimally active and health-enhancing physical activity (HEPA).³⁵ The Compendium of Physical Activities which lists 605 specific activities was used to characterize physical activities at different levels of effort based on the standard of a MET. Each activity was assigned an intensity level based on the rate of oxygen used by the body during physical activity. Calculation from a past week's recall of physical activity was done as follows:

$$\text{MET-mins/day} = (\text{frequency} \times \text{time} \times \text{intensity}) / 7 \text{ days.}$$

2.5.4 Statistical methods

The Health Science Faculty of the University of Stellenbosch assigned a statistician, Prof. DG Nel, who analyzed the necessary data by using STATISTICA 7 (a data analysis software system). The statistics program used can be found on the web site Statsoft.com.⁴¹ Representation and comparison of nominal variables were performed by the chi-square tests. The analyses of continuous variables were performed by univariate tests of significance. The non-parametric test, the chi-square test, was used to compare continuous variables with nominal variables.

2.6 ETHICS AND LEGAL CONSIDERATIONS

The Committee for Human Research of the Health Science Faculty of the University of Stellenbosch, Tygerberg, South Africa approved a research protocol (Appendix 1) for the rationale of the study (Ref. N04/10/170) that was submitted. Thereafter, the Administrative Committee of AllIAS was approached for permission regarding the students who would participate voluntarily.

Strict measures were taken to protect the subjects by signing a consent form and upon signing the consent form; I.D numbers were issued to protect the participant's identity. Incentives (in the form of a booklet entitled God's Pathway to Healing Heart by Reginald B.Cherry, M.D) were given to express gratitude for participation. It contains information on cardiovascular disease and also gives advice on better alternatives with regards to their lifestyle and dietary choices.

During the first visit respondents were visited and given a consent form (Appendix 10) that summarized the study objectives in English - a condensed outline was communicated, verbally and on paper. They were allowed sufficient time to inquire about all aspects relative to the study.

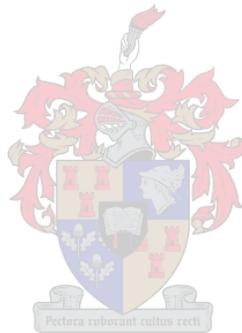
2.7 PILOT STUDY

A pilot study was carried out in order to standardize the measurement procedures as well as the measurers. The pilot study was conducted for this purpose only. Ten participants were randomly selected from the 153 respondents of the dietary survey and were excluded in the data analysis section.

The investigator only completed the first visit, along with the second and fifth visit (Figure 2.1). Based on this, one face-to-face interview was performed on all foods eaten and liquids drank during the previous day, a 24-hour period. The investigator checked for completeness and queries of the other questionnaires (socio-demographic, lifestyle and dietary) that were handed to the participants.

Participants were able to complete the questionnaires after technicalities regarding the terminology usage of various foods in the SFFQ were explained. The type of technicalities that had to be explained were of a minor nature, and the investigator was able to clarify the terminology used and any misunderstandings regarding this matter, without influencing the subjects'

decisions and choices regarding their dietary intake habits for the previous year. Thus the questionnaires were understood and face validity was considered acceptable. No complications accompanied the rest of the procedures in this study.

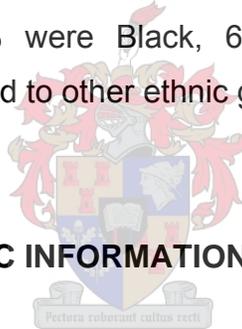


CHAPTER 3: RESULTS

3.1 SAMPLING CHARACTERISTICS

3.1.1 Sample description

For the purpose of this study, semi-vegetarians eating both fish and chicken occasionally (2-3 times per week but excluding all other meats) and lacto-ovo vegetarians (inclusion of dairy and eggs only 2-3 times per week) were included in the vegetarian cohort. The reason for this is that only a small group of vegetarians resided at AIAS at the time of the study. Consequently, non-vegetarians were those who ate all of the above foods frequently (>2-3 times per week), including all other meats and meat products in their diet. The cohort (n = 70) therefore comprised 38 (54%) non-vegetarian, and 32 (46%) “semi-vegetarian” and lacto-ovo vegetarian subjects. In terms of ethnicity, 10% of the subjects were Whites, 17.1% were Black, 61.4% were Asian and Pacific islanders, whilst 11.4% belonged to other ethnic groups.



3.2 SOCIO-DEMOGRAPHIC INFORMATION

3.2.1 Age and gender

The mean age and standard deviation (SD) of the subjects for non-vegetarian (n = 38) and vegetarian groups (n = 32) were 34.5 (1.4) and 35.8 (1.5) years respectively. There was also no significant differences by gender ($p > 0.05$) [males: non-vegetarian 33.3 (1.6); vegetarian 38.4 (1.9); females: non-vegetarian 35.7 (2.0); vegetarian 33.2 (2.1)].

3.2.2 Marital status

The majority of the participants (n = 56) were married in both groups (n = 28 in each group). More non-vegetarians (n = 10) than vegetarians (n = 4) were characterized as being single. There were no overall significant gender-related differences ($p > 0.05$) for marital status between the dietary cohorts of this study.

3.2.3 Annual source of Income

Nearly half (n = 36) the subjects' entire annual income was insignificantly below \$10,000. The rest of the subjects (n = 34) were scattered in the remainder categories with no significant differences. The prevalence of annual income of subjects by dietary practices and gender showed that the majority of the vegetarians' income was insignificantly below \$10,000 as compared with non-vegetarians (Figure 3.1 and Figure 3.2). Eighteen of the subjects (males n = 8; females n = 10) refused to give any information on their income and some were also unsure of how much they had earned in a typical year ($p > 0.05$).

3.2.4 Educational level

The prevalence of the 3 education categories, (Category A = Some college education; Category B = College graduate; Category C = Postgraduate/Professional degree), were stratified for subjects by dietary practices and gender (Figure 3.3). The majority of students (n = 37) finished the graduate level of education or was in the process of completing it, whilst the remainder (n = 33) was pursuing a postgraduate or professional degree ($p > 0.05$). Variations in levels of education between the dietary groups were small and inconsistent. Fifty-four percent non-vegetarian and 46% vegetarians made up the first group (Category A) while 46% non-vegetarian and 54% vegetarian in the last group (Category C).

Annual Income of Males

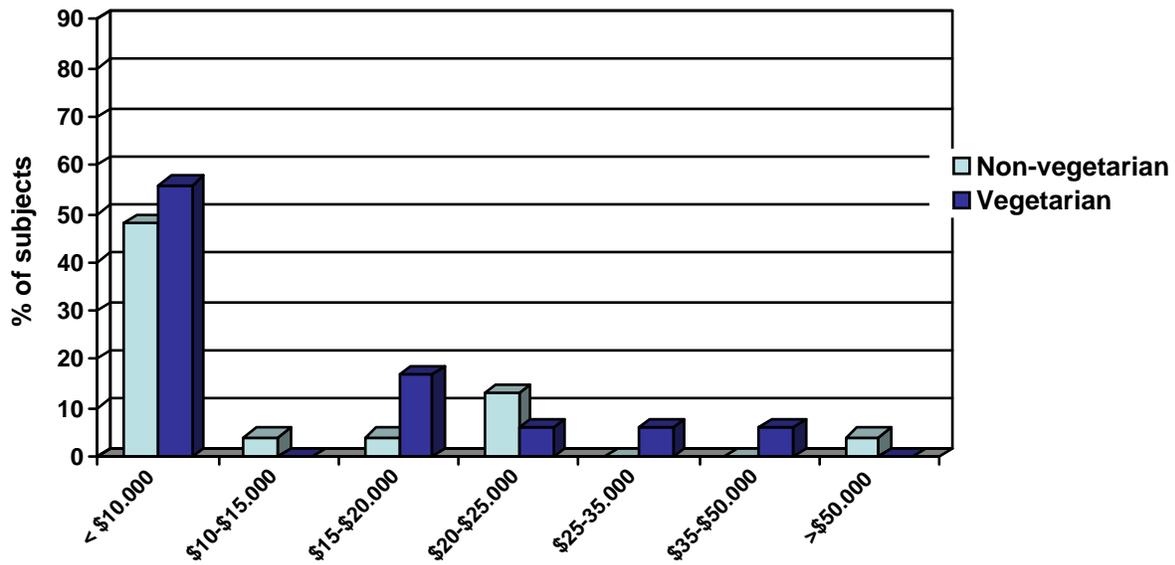


Figure 3.1: The prevalence of annual income (\$10,000-\$50,000) of male subjects included in the study by dietary practices.

Annual Income of Females

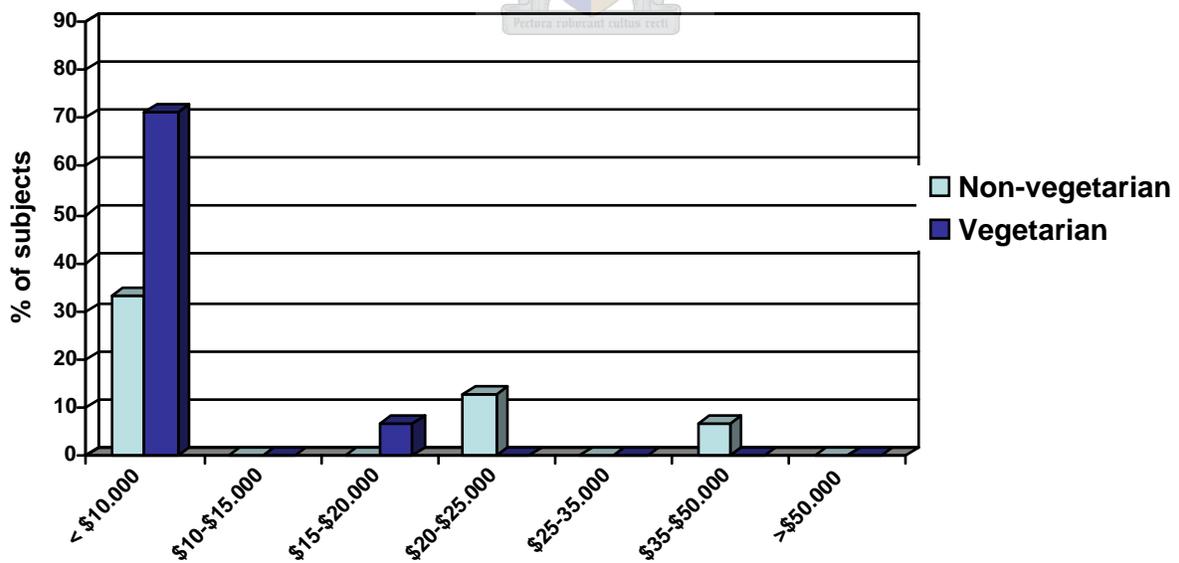


Figure 3.2: The prevalence of annual income (\$10,000-\$50,000) of female subjects included in the study by dietary practices.

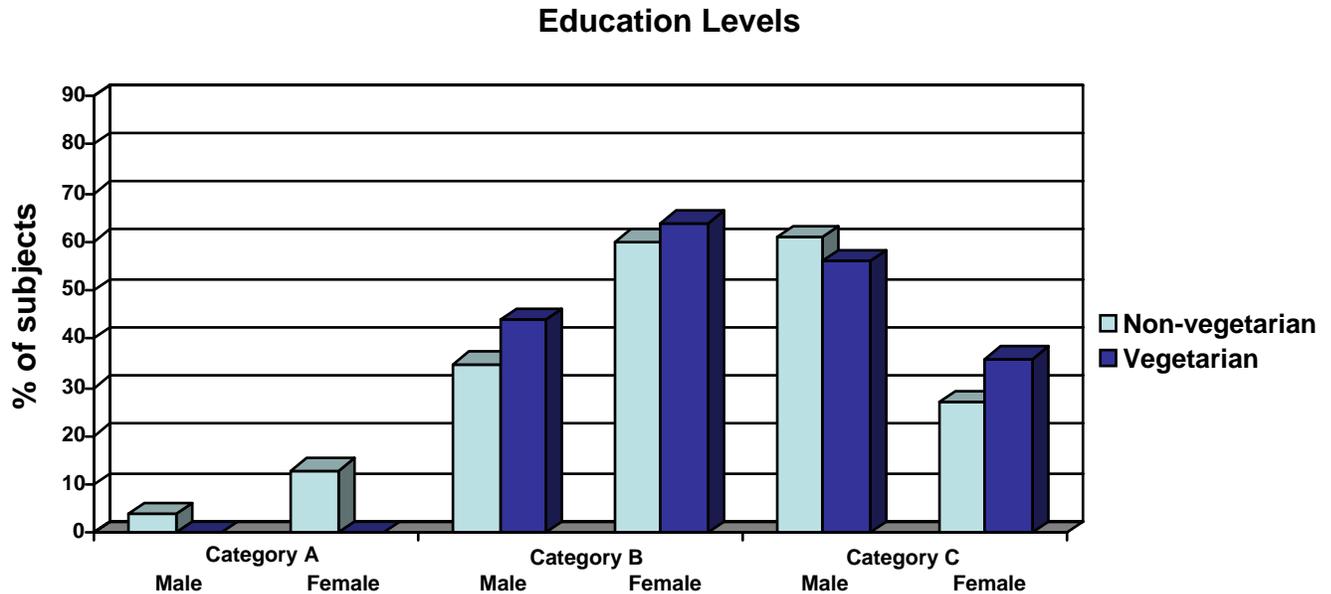


Figure 3.3: The prevalence of education categories of subjects included in the study by dietary practices and gender.

3.3 ANTHROPOMETRIC DATA

3.3.1 Anthropometric characteristics

The results were represented by the mean (SD) [95% CI], where SD indicates standard deviation and CI the confidence intervals, respectively. The mean (SD) [95% CI] for BMI for non-vegetarian and vegetarian subjects was 23.2 kg/m² (0.6) [21.9-24.5] and 22.7kg/m² (0.7) [21.3-24.1] respectively with no significant difference between the two groups (Table 3.1). The corresponding data for waist circumference (WC) was 80.5cm (1.6) [77.2-83.8] for non-vegetarian and 78.4cm (1.7) [74.9-81.9] for vegetarian subjects with no significant difference observed ($p>0.05$).

3.3.1.1 Body mass index (BMI)

According to the data analysis, different BMI cut-off points were used, thus the WHO cut-off points were not used for all ethnic groups (e.g. Asians and Pacific Islanders).³⁷ Despite the insignificant differences ($p>0.05$) in the mean BMI between the two groups, the prevalence of overweight, pre-obese and obese

status of subjects, using the WHO BMI criteria indicated that more non-vegetarian males were overweight (4%), pre-obese (22%) and obese (30%) as compared to the vegetarians (0%), (11%) and (11%) respectively ($p = 0.1$). Similarly, more overweight non-vegetarian (20%) than vegetarian females (0%) were seen. By contrast, more vegetarian females were pre-obese (21%) than the non-vegetarians (0%). Lastly, the prevalence of obese non-vegetarian and vegetarian females was the same (7%) ($p = 0.06$) (Figure 3.4).

Table 3.1: Anthropometric characteristics of the subjects included in the study (n=70) by dietary practices and by gender.

Variables	Non-vegetarian		Vegetarian		P-value
	Males (n=23) Mean (SD) [95% CI]	Females (n=15) Mean (SD) [95% CI]	Males (n=18) Mean (SD) [95% CI]	Females (n=14) Mean (SD) [95% CI]	
BMI (kg/m²)	24.3 (0.8) [22.8-26.0]	22.0 (1.0) [20.0-24.1]	22.9 (0.9) [21.1-24.8]	22.5 (1.0) [20.5-24.7]	0.32
WC (cm)	85.1 (2.1) [81.0-89.2]	75.9 (2.5) [70.8-81.0]	83.7 (2.3) [79.0-88.3]	73.2 (2.7) [67.9-78.4]	0.80

Abbreviations: BMI=body mass index, WC=waist circumference.

3.3.1.2 Waist circumference

Despite the insignificant differences in the mean WC between the two groups ($p > 0.05$) (Table 3.1), a significantly higher percentage of non-vegetarians (21%) appeared in the alert zone (action level 1 [≥ 94 cm, ≥ 90 cm for males and ≥ 80 cm for females]) as compared with the vegetarians (4%) for males. More vegetarians (6%) appeared in the action zone (action level 2 [≥ 102 cm for males and ≥ 88 cm for females]) as compared with the non-vegetarians (0%) for the male cohort ($p < 0.05$). For the female cohort, 7% non-vegetarians and 14% vegetarians appeared in the alerting zones ($p = 0.4$) (Figure 3.5).

BMI Classification

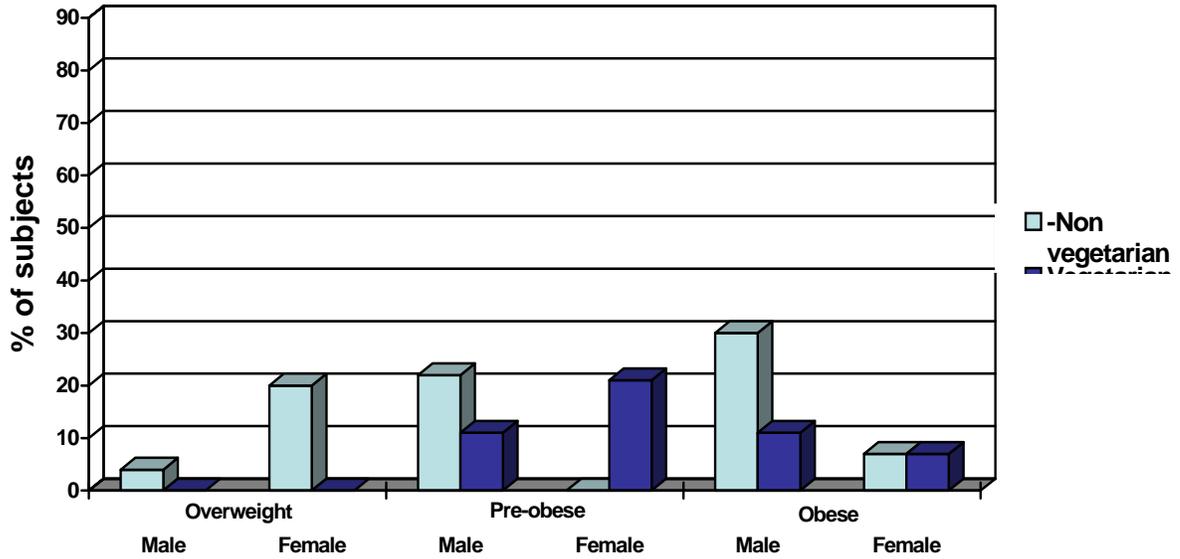


Figure 3.4: The prevalence of WHO and “The Asia Perspective” classifications for BMI (overweight, pre-obese and obese) of subjects included in the study by dietary practices and gender.

Waist circumference

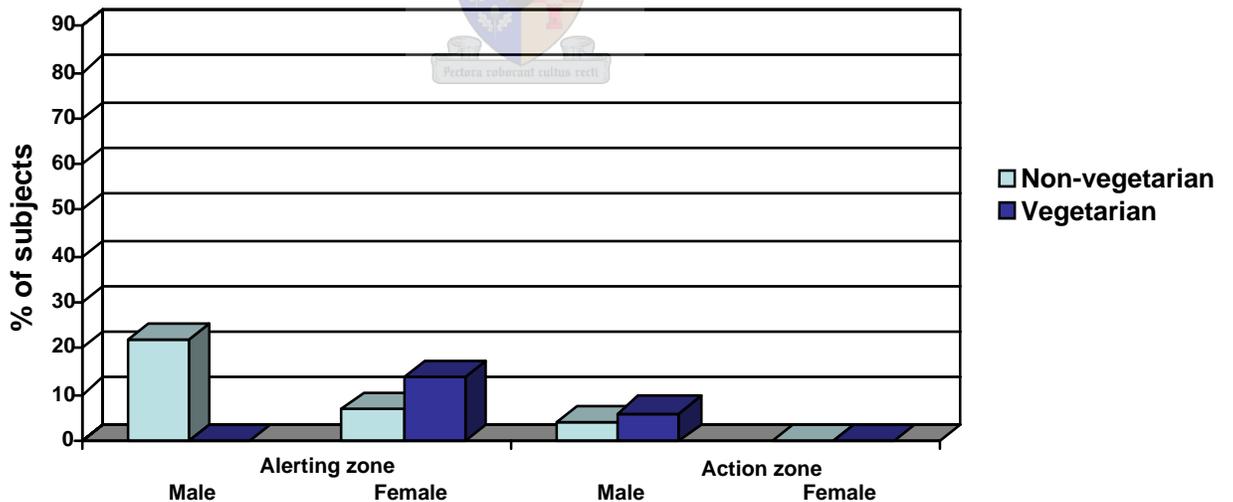


Figure 3.5: The prevalence of the alerting and action zones (Levels 1 and 2) for WC of subjects included in the study by dietary practices and gender.

3.4 LIFESTYLE INFORMATION

3.4.1 Physical activity

The results were insignificant between the two groups by gender ($p > 0.05$). For male subjects, 30%, 57% and 13% of non-vegetarians and 33%, 50% and 17% of vegetarians were inactive, minimally active and engaged in HEPA, respectively. Similarly there were 40%, 53% and 7% of non-vegetarians and 7%, 79% and 14% of vegetarians who were inactive, minimally active and who engaged in HEPA for females respectively (Figure 3.6).

3.4.2 Smoking

All subjects in both groups were non-smokers at the time of the investigation. However, 3 (13%) of male non-vegetarians and 1 (6%) of male vegetarian subjects had smoked in the past but had not been smoking for more than 5 yrs ($p = 0.3$).

3.4.3 Alcohol intake

None of the subjects consumed alcohol. This information was obtained by the self-administered food frequency questionnaire as well as the 24-hour recall where subjects' response to intake was negative in this regard.



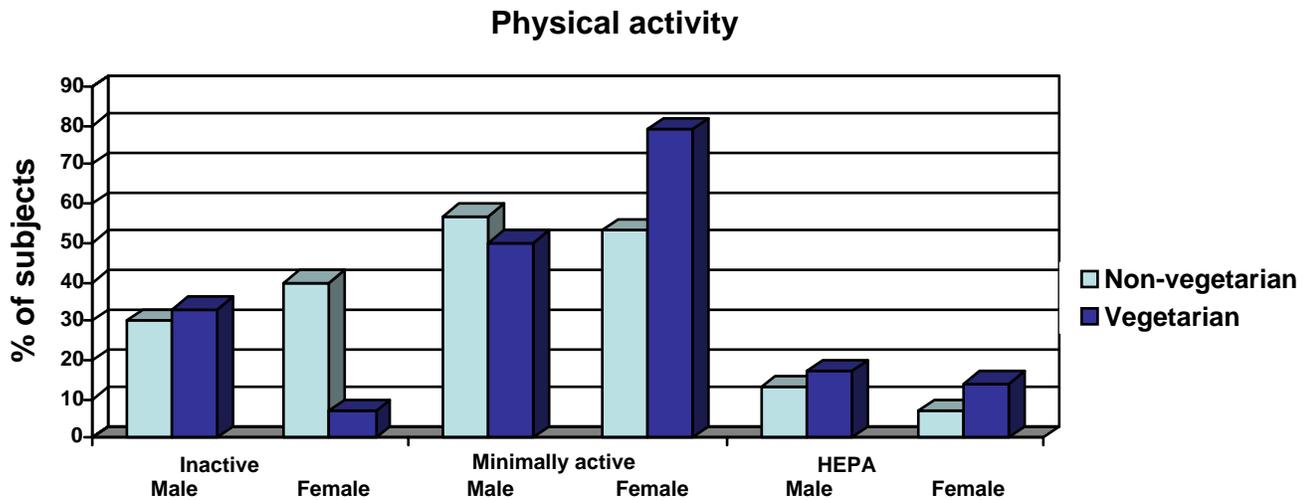


Figure 3.6: The prevalence of physical activity classification of subjects included in the study by dietary practices and gender.

Abbreviation: HEPA=Health-enhancing physical activity

3.5 DIETARY INFORMATION

3.5.1 Comparison of dietary preferences

For the 24-Hour recall, the majority of the subjects ($n = 64$) had been interviewed, as planned, on 3 non-consecutive times. The remainder of subjects ($n = 6$) however was interviewed on two of the three occasions because they were not home at the time of the randomized visit. The completed SFFQs were returned on the website with a special password provided. There were no error reports regarding the SFFQs sent in for processing.

3.5.1.1 Comparison of non-vegetarian and vegetarian subjects

The mean (SD) and confidence intervals of daily habitual energy and nutrient intakes for subjects by dietary practices indicated that the nutrient intake was similar in both groups. The p-values used were based on the average between the 24-hour recall and the FFQ. The intakes for carbohydrates and fibre were significantly higher in the vegetarians when compared with the non-vegetarians. The reverse was true for cholesterol where the non-vegetarians had a

significantly higher intake compared to the vegetarians (Table 3.2). The use of supplements was not assessed in this study.

When the intake of the subjects of the three dietary preferences (non-vegetarian, semi, and lacto-ovo vegetarians) was analyzed, cholesterol, fibre and vegetable protein were significantly different between the three dietary preferences ($p < 0.05$). The intake of the rest of the dietary variables did not differ significantly among the groups by dietary preference or gender (Appendix 11).

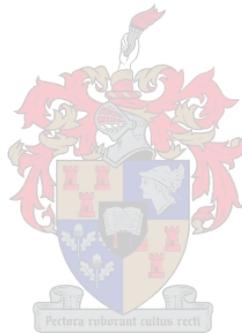


Table 3.2: The mean (SD) and confidence intervals of daily habitual energy and nutrient intakes of subjects included in the study by dietary practices.

Nutrient	Dietary Practices	
	Non-vegetarian (n = 38) Mean (SD) [95% CI]	Vegetarian (n = 32) Mean (SD) [95% CI]
Energy (kcal.)	p = 0.2	
24-Hr recall	1825 (109.9) [1605.7-2044.3]	1970.2 (119.8) [1731.1-2209.2]
SFFQ	1368.4 (107.1) [1154.6-1582.1]	1461 (116.7) [1228.1-1693.9]
Protein (g)	p = 0.6	
24-Hr recall	64.2 (5.4) [53.6-75]	55.5 (5.8) [43.8-67.2]
SFFQ	49.4 (4.1) [41.0-57.7]	49.5 (4.5) [40.3-68.5]
Carbohydrate (g)	p = 0.05	
24-Hr recall	267.9 (15.5) [236.8-299.0]	300.9 (16.9) [267.1-334.8]
SFFQ	205.1 (15.3) [173.5-235.6]	235.1 (16.6) [201.8-268.4]
Fat (g)	p = 0.3	
24-Hr recall	50.4 (4.7) [41.0-59.9]	59.1 (5.1) [48.8-69.4]
SFFQ	42.7 (4.2) [34.2-51.3]	41.9 (4.6) [32.7-51.3]
Cholesterol (g)	p = 0.04	
24-Hr recall	183.0 (22.0) [139.0-227.1]	153.5 (24.0) [105.5-201.4]
SFFQ	194.5 (17.7) [159.1-229.9]	122.5 (19.3) [83.9-161.0]
Saturated fatty acids (g)	p = 0.9	
24-Hr recall	12.8 (1.5) [9.8-15.8]	13.6 (1.6) [10.3-16.9]
SFFQ	12.4 (1.4) [9.6-15.2]	11.0 (1.5) [7.9-14.0]
Monounsaturated fatty acids (g)	p = 0.3	
24-Hr recall	17.2 (1.7) [13.7-20.7]	20.3 (1.9) [16.5-24.1]
SFFQ	15.6 (1.5) [12.4-18.7]	15.5 (1.7) [12.1-19.0]
Polyunsaturated fatty acids (g)	p = 0.08	
24-Hr recall	10.3 (1.2) [7.7-12.9]	13.4 (1.3) [11.0-16.6]
SFFQ	10.5 (1.1) [8.3-12.6]	11.0 (1.1) [8.7-13.3]
Fibre (g)	p = 0.001	
24-Hr recall	15.5 (1.3) [12.8-18.2]	18.7 (1.4) [15.8-21.6]
SFFQ	18.0 (1.3) [15.4-20.7]	23.6 (1.4) [20.7-26.5]
Vitamin B12 (ug)	p = 0.5	
24-Hr recall	1.2 (0.3) [0.6-1.8]	0.9 (0.3) [0.2-1.6]
SFFQ	3.6 (0.6) [2.4-4.9]	2.5 (0.6) [1.1-3.9]
Vitamin D (ug)	p = 0.2	
24-Hr recall	-	-
SFFQ	3.2 (0.4) [2.3-4.2]	2.2 (0.5) [1.1-3.3]
Calcium (mg)	p = 0.1	
24-Hr recall	473.4 (55.3) [362.9-584.0]	693.7 (59.4) [575.0-812.3]
SFFQ	579.3 (59.6) [460.3-698.4]	576.0 (64.0) [448.3-703.9]
Iron (mg)	p = 0.06	
24-Hr recall	11.2 (0.6) [9.8-12.6]	10.7 (0.7) [9.2-12.3]
SFFQ	11.9 (0.8) [10.2-13.7]	14.1 (0.9) [12.1-15.9]
Zinc (mg)	p = 0.8	
24-Hr recall	4.2 (0.3) [3.4-4.9]	4.1 (0.4) [3.3-5]
SFFQ	7.8 (0.8) [6.1-9.5]	8.3 (0.9) [6.5-10.1]

*P-values were derived from the average of the two dietary techniques

3.5.1.2 Comparison of energy and nutrient intakes of subjects included in the study by dietary practices and gender.

According to both dietary methods, vegetarians had a higher mean energy intake than the non-vegetarians for both genders (Table 3.3). The only exception was the non-vegetarian males who had a higher energy intake than their counterparts according to the 24-hour recall. None of the differences in energy and nutrient intake were significant, with the exception in mean fat intake and saturated fat which was significantly ($p = 0.04$) higher in vegetarian females and non-vegetarian males when assessed by the 24-hour recall. The p -values were based on the average of the two dietary techniques.

Furthermore, the type of protein between the two groups differed but not significantly so ($p > 0.05$). The mean (SD) [95% confidence interval (CI)] for animal protein for non-vegetarian and vegetarian males was 25.3 (4.1) [16.9-33.6] and 15.2 (4.7) [5.9-24.6]. Similar data were obtained for females, 20.6 (5.1) [10.3-30.9] and 15.5 (5.3) [4.8-26.1] respectively.

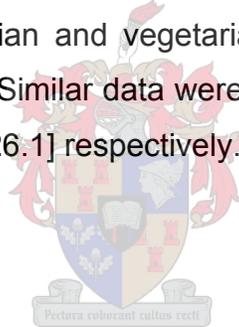


Table 3.3: The mean (SD) and confidence intervals of daily energy and nutrient intakes of subjects included in the study by dietary practices and gender.

Nutrient	AMDR/AI* (M) Male (F) Female	EAR/UL (M) Male (F) Female	Non-vegetarian		Vegetarian	
			Males (n=23) Mean (SD) [95% CI]	Females (n=15) Mean (SD) [95% CI]	Males (n=18) Mean (SD) [95% CI]	Females (n=14) Mean (SD) [95% CI]
Energy (cal.)						
p = 0.2						
24-Hr recall			2035.5 (131.6) [1772.7-2298.2]	1642.6 (162.9) [1317.2-1967.9]	1930.3 (148.8) [1633.3-2227.2]	2099.1 (168.6) [1762.3-2435.9]
SFFQ			1357.8 (139.7) [1096.9-1654.8]	1357 (173.0) [1011.6-1702.5]	1478.3 (157.9) [1162.9-1793.6]	1438.9 (179.1) [1081.3-1796.4]
Protein (g)						
p = 0.1						
24-Hr recall	(10%-35%)/56*	46/ND (M)	72.4 [58.9-86.0]	51.8 [34.4-60.3]	49.5 [37.2-61.8]	60.8 [43.5-78.1]
SFFQ	(10%-35%)/46*	38/ND (F)	50.9 [40.1-61.8]	46.8 [33.4-60.3]	51.4 [36.1-66.7]	49.4 [35.5-63.3]
Carbohydrate (g)						
p = 0.4						
24-Hr recall	(45%-65%) 130*	100/ND (M)	281.1 (20.1) [240.9-321.4]	247.8 (24.9) [197.9-297.5]	297.1 (22.7) [251.6-342.6]	305.2 (25.8) [254.3-357.4]
SFFQ	(45%-65%) 130*	100/ND (F)	205.7 (19.9) [165.8-245.5]	204.2 (24.7) [154.8-253.5]	238.9 (22.5) [193.9-284.1]	230.2 (25.6) [179.1-281.3]
Fat (g)						
p = 0.04						
24-Hr recall	(20%-35%)	ND	55.8 (5.9) [43.9-67.7]	42.3 (7.3) [27.6-56.9]	51.2 (6.6) [37.9-64.6]	69.3 (7.5) [54.1-84.5]
SFFQ	(20%-35%)	ND	42.2 (5.6) [31.0-53.4]	43.6 (6.9) [29.7-57.4]	42.3 (6.3) [29.6-54.9]	41.6 (7.1) [27.2-55.9]
Cholesterol (g)						
p = 0.1						
24-Hr recall	**	ND	221.2 (27.7) [165.8-276.6]	124.5 (34.3) [55.9-193.1]	145.3 (31.4) [82.7-208.0]	163.8 (35.6) [92.8-234.8]
SFFQ		ND	186.3 (23.0) [140.3-232.3]	207.2 (28.5) [150.2-264.2]	115.3 (26.1) [63.3-167.4]	131.8 (29.5) [72.8-190.7]
Saturated fatty acids (g)						
p = 0.04						
24-Hr recall	**	ND	14.5 (1.9) [10.7-18.3]	10.3 (2.3) [5.6-14.9]	11.2 (2.1) [6.9-15.4]	13.6 (1.6) [10.3-16.]
SFFQ		ND	12.1 (1.8) [8.4-15.8]	13.1 (2.2) [8.5-17.6]	10.9 (2.0) [6.7-15.0]	11.2 (2.3) [6.4-15.9]
Monounsaturated fatty acids (g)						
p = 0.1						
24-Hr recall		ND	18.6 (2.2) [14.1-23.1]	15.1 (2.7) [9.5-20.6]	18.1 (2.5) [13.0-23.2]	23.1 (2.8) [17.4-28.9]
SFFQ		ND	15.4 (2.0) [11.2-19.5]	15.8 (2.5) [10.7-21.0]	15.8 (2.3) [11.1-20.5]	15.2 (2.6) [9.9-20.6]
Polyunsaturated fatty acids (g)						
p = 0.3						
24-Hr recall	(5%-10%)	ND	10.2 (3.2) [3.7-16.6]	8.9 (4.0) [0.9-16.8]	13.4 (3.6) [6.1-20.7]	19.6 (4.2) [11.3-27.9]
SFFQ	(5%-10%)	ND	10.3 (1.4) [7.4-13.1]	10.9 (1.7) [7.4-14.4]	11.1 (1.6) [7.9-14.2]	10.9 (1.8) [7.3-14.5]
Fibre (g)						
p = 0.2						
24-Hr recall	38*	ND	15.9(2.6) [10.8-21.0]	13.9 (3.1) [9.7-18.2]	20.7 (2.8) [14.9-26.5]	24.2 (3.2) [17.7-30.8]
SFFQ	25*	ND	17.5 (1.7) [14.0-20.9]	18.9 (2.1)[14.6-23.2]	23.7 (1.9) [19.8-27.6]	23.5 (2.2) [19.1-27.9]
Vitamin B12 (ug)						
p = 0.6						
24-Hr recall	2.4*	2.0/ND (M)	1.0 (0.3) [0.2-1.7]	0.5 (0.4) [-0.3-1.5]	1.2 (0.4) [0.3-2.0]	0.8 (0.4) [-0.1-1.8]
SFFQ		2.0/ND (F)	4.0 (0.8) [2.4-5.7]	2.9 (1.0) [0.9-5.0]	2.6 (0.9) [0.7-4.5]	2.5 (1.0) [0.3-4.6]
Vitamin D (ug)						
p = 0.9						
24-Hr recall	5*	ND/50 (M)	-	-	-	-
SFFQ		ND/50 (F)	3.3 [2.0-4.6]	3.0 [1.4-4.6]	2.3 [0.9-3.8]	2.1 [0.4-3.7]
Calcium (mg)						
p = 0.1						
24-Hr recall	1000*	ND/2500 (M)	504.6 (69.6) [365.7-643.5]	442.3 (86.1) [270.3-614.3]	582.6 (78.6) [425.6-739.6]	804.8 (89.1) [626.8-982.8]
SFFQ		ND/2500 (F)	570.1 (74.9) [420.6-719.6]	588.5 (92.8) [403.4-773.7]	571.3 (84.7) [402.3-740.3]	580.8 (96.0) [389.1-772.5]
Iron (mg)						
p = 0.7						
24-Hr recall	8*	6/45 (M)	11.4 (1.4) [8.6-14.2]	9.8 (1.7) [6.3-13.3]	12.1 (1.6) [8.8-15.2]	12.6 (1.7) [9.0-16.2]
SFFQ	18*	8.1/45 (F)	12.6 (1.1) [10.2-14.8]	11.1 (1.4) [8.3-13.9]	14.4 (1.3) [11.8-17.0]	13.6 (1.4) [10.7-16.5]
Zinc (mg)						
p = 0.7						
24-Hr recall	8*	9.4/40 (M)	4.3 (0.8) [2.7-5.8]	4.2 (0.9) [2.2-6.1]	3.8 (0.8) [2.0-5.5]	4.1 (0.9) [2.1-6.1]
SFFQ	11*	6.8/40 (F)	8.5 (1.10) [6.3-10.7]	6.7 (1.3) [4.0-9.4]	8.4 (1.2) [5.9-10.8]	8.2 (1.3) [5.4-10.9]

Abbreviations: AMDR= Acceptable macronutrient distribution ranges, AI=Adequate intake, EAR=Estimated average intake, UL=Upper tolerable estimated level, ND=Not determinable, p=p value. **As low as possible³⁶

3.5.3 The dietary variables compared with the dietary reference intakes by dietary preferences and gender.

The frequencies and percentages of respondents with intakes deviating from the EERs and AMDRs for dietary preferences and gender were determined (Table 3.4). Intakes below the estimated energy requirements (EERs) for energy were most prevalent for both groups (refer to Appendix 13). Almost half of the non-vegetarians and vegetarians' protein intake was below the AMDRs. The majority of the subjects for both dietary preferences fell within the accepted range (20%-35%) for average fat intake according to the AMDRs. Likewise, both dietary pattern groups achieved the acceptable level (5-10%) of polyunsaturated fatty acids (PUFA) as recommended by the AMDRs. Few subjects in both dietary groups were striving to keep their intakes of cholesterol as low as possible (300mg or less per day) while majority were greater than the recommendation (7% or less per day) for intakes of SFA. Similar results were observed for the genders. Females however, had higher intakes of cholesterol and SFA as compared to males ($p > 0.05$).

The frequencies and percentages of respondents with intakes less than the EAR and greater than the UL for selected micronutrients determined for both dietary groups and genders were as follows (Table 3.5). For the consumption of vitamin B12 and iron, there were more non-vegetarians who had intakes less than the EAR as compared with the vegetarians with no considerable differences. Intakes of vitamin B12 and zinc for males and females were less than the EAR with males being most prevalent ($p = 0.04$). On the other hand, females were most prevalent for having intakes of iron less than the EARs. Inadequate intakes for iron were significantly most prevalent in females. Observing calcium intake however, both dietary preference groups or by gender were below the 1000mg/day indicating possible risk for inadequacy.³⁹

Table 3.4: Frequencies and percentages of respondents with intakes deviating from the EERs and AMDRs for dietary variables by dietary preferences and gender.

Nutrient	Non-vegetarian (n=38) n (%)	Vegetarian (n=32) n (%)	Males (n=29) n (%)	Females (n=41) n (%)
Energy (Kcal); EER range: refer to Appendix 12	p=0.06		p=0.1	
< EERs	33 (86)	29 (90)	38 (93)	24 (83)
> EERs	5 (13)	1 (3)	3 (7)	3 (10)
Protein (g); AMDR: 10-35%	p=0.2		p=0.4	
< 10-35%	22 (58)	13 (40)	22 (53)	13 (44)
> 10-35%	-	-	-	-
Carbohydrate (g); AMDR: 45-65%	p=0.6		p=0.1	
< 45-65%	2 (5)	1 (3)	-	3 (10)
> 45-65%	-	-	-	-
Fat (g); AMDR: 20-35%	p=0.1		p=0.3	
< 20-35%	5 (13)	10 (31)	10 (24)	5 (17)
> 20-35%	4 (10)	1 (3)	4 (10)	1 (4)
Cholesterol (g); AMDR: ALAP*	p=0.9		p=0.2	
< 300mg	13 (34)	11 (34)	15 (37)	9 (31)
> 300mg	4 (10)	3 (9)	2 (5)	5 (17)
Saturated fatty acids (g); AMDR: ALAP*	p=0.9		p=0.4	
< 7%	10 (27)	8 (25)	12 (30)	6 (21)
> 7%	27 (73)	23 (74)	28 (70)	22 (79)
Polyunsaturated fatty acids (g); AMDR: 10%	p=0.08		p=0.6	
<10%	4 (10)	3 (9)	3 (7)	4 (13)
>10%	21 (55)	25 (78)	28 (68)	18 (62)

*The recommendation according to the DRIs is to keep this nutrient as low as possible. There is no exact amount given, however a daily intake of 300mg of cholesterol and 7% of Saturated fatty acids were used as a benchmark.³⁸

Table 3.5: Frequencies and percentages of respondents with intakes less than the EAR and greater than the UL for micronutrients by dietary preferences and gender.

Nutrient	Non-vegetarian (n=38) n (%)	Vegetarian (n=32) n (%)	Males (n=29) n (%)	Females (n=41) n (%)
Vitamin B12 (ug) EAR: 2ug; UL: ND	p=0.8		p=0.02	
<EAR	21 (55)	17 (53)	27 (66)	11 (37)
>UL	-	-	-	-
Iron (mg) EAR: 6mg (M) and 8.1mg (F); UL: 45mg	p=0.2		p=0.04	
<EAR	7 (18)	3 (9)	3 (7)	7 (24)
>UL	-	-	-	-
Zinc (mg) EAR: 9.4mg (M) and 6.8mg (F); UL: 40mg	p=0.9		p=0.04	
<EAR	26 (68)	22 (69)	32 (78)	16 (55)
>UL	-	-	-	-

Abbreviations: EAR=Estimated average intake, UL=Upper tolerable estimated level, ND= Not determinable, M= Male, F= Female.

CHAPTER 4: DISCUSSION

4.1 STUDY OUTCOME IN TERMS OF OBJECTIVES

4.1.1 Dietary patterns

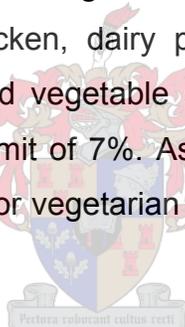
The first objective to consider is the assessment of the two dietary preferences and their relation to CHD risk. Notably, there were statistically significant results found for mean fat and SFA intakes. Mean fat and SFA intakes of vegetarian females were higher than non-vegetarian females according to the 24-hour recall. Non-vegetarians had higher mean intakes of these nutrients compared to the vegetarians of this study. Subsequently, AMDR showed that both groups' energy intake was below the recommendation. Furthermore, almost half of subjects had inadequate intakes of protein and majority had excessive intakes of SFA with no significant differences. Most subjects for both dietary cohorts had inadequate intakes of vitamin B12 and zinc. There were no excessive intakes as compared with the ULs.³⁹

4.1.1.1 Presence of risk factors in the non-vegetarian and vegetarian groups of this study

Independently, dietary data assessed in this study had shown some important issues to contemplate. Firstly, the investigator agrees with the concept that Dr. TC. Campbell made regarding the China study where he also compared non-vegetarian and vegetarian subjects. He stated that the quality of energy intake plays a vital part in dietary regimes as well as the quantity.^{5,42} Additionally, similar results were found in a meta-analysis. Evidence from prospective cohorts indicates that the quality of energy intake and the different dietary preferences affect the biochemical and physiological status of individuals.^{10,14} For example, higher intakes of fat, trans fatty acids, SFA and dietary cholesterol predisposes risk for developing CHD if abused by the dietary choices (quality) made.^{9,11,15,16,43} In this comparative study, dietary cholesterol and SFA were present in both dietary preferences as well as when the vegetarian group was also subdivided. The recommendation is that these factors should be kept as low as possible

because it causes direct increments in serum cholesterol levels.^{39,44,45} Lastly, recent evidence reiterates that the quality of fat is more important than that of the fat quantity in regard to CHD risk. For example, trans fatty acids increase the serum cholesterol levels, and thus increases the risk of CHD.^{44,46}

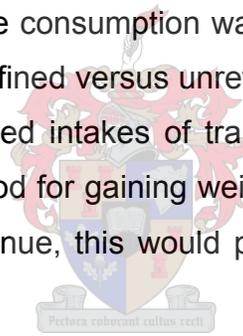
The higher fat intake determined by the 24-hour recall for vegetarian females, exposes possible contributing factors. Similar to the quality of energy intake, the quality of fat intake is also of importance. Indication of liberal consumption of fish, chicken and dairy products could have been an attributing factor. However, the lower intake of animal protein for female vegetarians as compared with the non-vegetarians on the other hand indicates a probable liberal use of mono- and polyunsaturated fats (such as nuts, legumes, soy, and vegetable oils) as observed.^{45,47} The SFA intake in the vegetarian group also indicated use of foods such animal products (fish, chicken, dairy products) and vegetable products (coconut oil, palm kernel oil, and vegetable shortening). SFA intake however, should have not exceeded the limit of 7%. As the data suggests, fat intake did not exceed the limit (25%-35%) for vegetarian females as well as by both dietary groups.^{39,44,45,47}



The presence of high intakes of animal protein creates a risk for CHD morbidity and mortality.^{43,44,46} Lipid profiles however, may be improved by a high protein diet, which in actual fact creates a problem for both dietary groups in this study.^{46,47} The question asked is which kind of protein is of beneficial use in regard to these two groups and the relativity to CHD risk and prevention. According to a recent article, there are potential beneficial aspects of plant protein because of the amino acid content it possesses.⁴⁸ Thus, it was questioned whether animal or plant protein was used predominantly and did it differ considerably between the two cohorts of this study. Unfortunately, due to the lack of a sizeable sample, the difference was quite small and insignificant. Merging of the semi-vegetarians with the lacto-ovo vegetarians also could have been a possible cause for insignificant results. Data had however shown that

vegetarians had higher intakes of carbohydrates and fibre as compared with the non-vegetarians but with no significant differences, indicating probable consumption of plant protein. The description of the dietary preferences showed consumption of fish, chicken and dairy products by semi-vegetarians and lacto-ovo vegetarians respectively, indicating that both groups had a probable intake of animal protein as well. According to the China Study, it was recommended that less animal protein be consumed and more vegetable protein.^{5,42} Considering these articles, it is apparent that the type of protein consumed could probably increase or decrease the risk of CHD.^{5,42,43,44,46,47,48} Half of all participants however, had a low intake of protein thus protein was not an attributing factor within this study.

A higher intake of carbohydrate was seen in the vegetarian cohort, unfortunately the type and preparation before consumption was not determined. The type and preparation of carbohydrate (refined versus unrefined) is also of importance. This may also contribute to increased intakes of trans fatty acids.^{44,46} Unfortunately this could establish the likelihood for gaining weight, a precursor for obesity, and whether the habit was to continue, this would present a risk for the vegetarian cohort.⁴



4.1.1.2 Adequacy and inadequacy of dietary intake by dietary preferences

Possible nutrient deficiency with consuming a vegetarian diet was not only a current concern within this group, but also in the non-vegetarian group who were consuming animal sources with cholesterol and SFA which should have been providing sufficient protein in its place.³⁹

From the data obtained, calcium was below the AIs and thus established possible risk of deficiency for this nutrient. It was the perception that vegetarian diets have been described as being deficient in several nutrients such as iron, zinc, calcium and vitamin B12 but Leitzmann states that a number of studies

have demonstrated that poor meal planning could have been the cause thereof.⁴⁹ Thus the suggestion that low levels for certain nutrients for both groups indicated poor meal planning.

The results show almost half of the subjects' entire annual income was below \$10,000, thus evidence of a probably low socio-economic status. Due to the low socioeconomic status, it was assumed that the subjects took no supplements. However, supplemental use could have increased the intake above the EAR in those who could have afforded supplements.

4.1.2 Prevalence of overweight and obesity

Potential grounds for normal BMI and WC scores for both dietary groups indicated a low energy intake and a high-energy expenditure for the sample of this study.^{17,50,51} This was clearly seen in the results that demonstrated a low energy intake. However, low to moderate exercise levels, including consumption of recommended energy intakes for age and activity level according to EER, was characterized by this sample. There was a low prevalence of vegetarian subjects in spite of this, whose BMI categorized them as being either overweight or obese, despite low reported energy intake. This raises some controversial aspects because a pooled analysis of prospective studies had shown that vegetarians had lower BMI scores than non-vegetarians.^{10,14}

Consequently, this raises some important aspects that need to be critically addressed. Firstly, the study sample was undersized and furthermore, characterized as graduate students who could have wished to convey desirable information pertaining to the dietary assessments.²⁸

The selection of various foods (such as processed and refined foods) could have attributed to unnecessary weight gain for both dietary preference groups.^{15,44,46,50} The dietary variables, fat and SFA *per se*, could have been the attributing factors to the increase in BMI especially in females. It was observed that female

vegetarians had higher intakes compared to the non-vegetarians, apart from the higher intakes of fibre. Strong associations were obtained between dietary variables, protein and fibre, and BMI in the EPIC-Oxford study.⁵⁰ The current study that was conducted did not show similar patterns.

Preponderance of fat storage could have influenced the BMI and WC, especially in females. Thus indicating the influence of not only non-genetic aspects (dietary consumption and lifestyle) but also genetic types.²⁸ It was observed in the female cohort that the vegetarians' mean BMI were higher than the non-vegetarians. The reverse was seen for WC where non-vegetarians' mean WC scores were higher than the vegetarians. The predominance of fat in the hips and thighs, namely gynoid shape, was observed in this cohort who had higher BMI scores compared to the lower WC scores. It should be emphasized that the gynoid fat distribution is associated with a lower risk for CHD while the android fat distribution (preponderance of fat in the abdomen) increases risk for CHD.^{17,18,19,20} Moreover, as demonstrated for the dietary assessment, the subjects could have also influenced the anthropometric assessment. The subject could have influenced his/her measurement by not relaxing their abdomens while taking the measurement, even though they were expressly asked to, because of embarrassment. Measurement bias on measurers was prevented since all strict protocol was followed.

The sample of this study was small and the anthropometric results therefore cannot be extrapolated to the general population. However, evidence of normal anthropometric measurements for vegetarians were observed.^{10,11,14,15,16} The prevalence for overweight and obese subjects illustrated in this study showed future risk of CHD. The preponderance of vegetarian subjects in categories given for WC also showed future risk of CHD for a small percentage of the sample since the mean values was within the normal WHO ranges. If intervention were not employed for both dietary cohorts this would inevitably lead to CHD morbidity and eventually mortality.^{17,18}

4.1.3 Prevalence of physical activity

Another aspect improving the nutritional status of subjects is physical activity. The health benefits of physical activity are cited elsewhere.^{21,22} According to a recent critique, physical activity can be used for the prevention and intervention of obesity, which predisposes risk for CHD.⁵¹ A prospective study of vegetarian and health-conscious non-vegetarian subjects that were followed for 21 years substantiated the beneficial claims of physical activity. It was able to reduce the risk of morbidity and mortality among those who are already following a healthy lifestyle.⁴³ In this study approximately half of the participants engaged in a form of moderate exercise regardless of their dietary preferences. Thus, almost half of the sample for both dietary groups lowered their risk of CHD just by incorporating this aspect within their lifestyle.^{23,43}

4.1.4 Prevalence of other lifestyle factors

The lifestyle evaluation incorporated two other aspects that could influence the two dietary cohorts risk of CHD. The prevalence of certain lifestyle aspects (non-smokers and no alcohol consumption) by the non-vegetarian and vegetarian subjects in this study appeared to provide a substantially lower risk of CHD.^{10,15} Fortunately for this study sample, lower risk exposure was prevalent for all subjects.

According to a study performed on lifestyle determinants and mortality in German vegetarians and health-conscious persons, low prevalence of smoking is associated with lower risk for CHD.⁴³ The findings of this study shows that all subjects lowered their risk because of this behavioral factor. Moreover, those who had previously smoked, stopped because of religious reasons (e.g. becoming an SDA) as supported by the data.

Dietary assessment analysis showed traces of alcohol consumption for non-vegetarian and vegetarian subjects. All participants had checked on the last page of the SFFQ for beverages, the “never or less than once a month” column for all

the alcohol beverages. The 24-hour recall also reported no use of alcohol. This only indicates that the traces found in the analyses could have been linked to certain food that the participants consumed which they were unaware of. Another point worth mentioning is that these subjects were residing at an Adventist institution, which has strict measures stating that students were not allowed to have any alcohol on the premises. Furthermore, most of these participants were Adventist believers who also avoided alcohol because of doctrinal beliefs. Therefore, for both groups, there was no consumption of alcohol for the past five years.

4.1.5 Socio-economic status

Within this cohort, similar results were obtained for education and annual source of income despite their dietary preferences. By observation, different dietary preferences were practiced among the subjects in spite of their high education level seen in both cohorts. Similarly, low annual source of income was observed in both dietary preference groups. Thus, resulting in the assumption that these subjects were able to consume a fairly well balanced meal due to the lower cost of living in the Philippines. Therefore the annual source of income, including the education level, was not an attributing factor in determining their dietary pattern choices.

4.2 THE STUDY AND ITS LIMITATIONS

4.2.1 Limitations of the study sample

4.2.1.1 Sample size

One of the major limitations of this study was that it was undersized compared to other studies that have carried out similar investigations, thus results from the study could not be extrapolated to the rest of the non-vegetarian and vegetarian

populations. Prospective studies with a large sample are more rigorous when it comes to making inferences regarding the whole population.^{42,51}

Additionally, Allias, the place where the study was decided to take place did not have a large number of registered students ($n = 203$). One of the criteria for inclusion was that the students were supposed to be registered at this Institution in order to participate. The estimation of a precision of 3% of the true proportion would need a small size of 517 for a population of 1000. However, there were only 203 of which only 153 responded, weakening the precision of the true proportion (Appendix 12). Fifty percent of the total eligible sample in each group was selected for inclusion in the main study. This was obtained after the exclusion of fifteen subjects who were vegan ($n = 2$), unknown ($n = 3$) categories and pilot study subjects ($n = 10$). The sample of seventy subjects was however a drawback due to the small sample used. The reason for this is that the response of students along with the logistics, instruments and also the budget of the study allowed the feasibility of studying only fifty percent of the sample.

4.2.1.2 Sample description

The populations used in other studies were mostly of western origin but in this study it was quite the opposite.^{10,14,15} Inclusion of a heterogeneous group of individuals was the criterion for this study. The age groups in this study were similar with other studies and it resolved to include both genders in the evaluation, which has been observed in other studies as well. The population was however a heterogeneous group of students with various ethnic backgrounds. This was accounted for by the data collection methods administered. The FFQ and the anthropometric classifications were both sensitive to this diverse group of subjects.^{20,37,31,32,34} Furthermore, due to the small population ($n = 203$) size it was decided to include all the ethnic groups.

The investigator's main intention was to contrast non-vegetarians with lacto-ovo vegetarians. However, due to the very small quantity present at Allias, semi-vegetarians and lacto-ovo vegetarians were combined to form the vegetarian

cohort. The location (Asia) and population (multi-ethnic) indicated the reason for the small number of lacto-ovo vegetarians. According to the survey handed out to determine dietary preferences, it was observed that most individuals considered themselves as vegetarians even though they seldom consumed animal produce. Fish produce however, is eaten more than chicken, as observed in this study, thus the vegetarian cohort followed a more prudent diet compared to the conventional western diet where red meat and processed meats are mostly eaten.⁴⁴ It was observed that the vegetarian group of this study consumed a substantial amount of fish, chicken and dairy products (2-3 times per week) even though plant-based foods should have supplied the major source of the diet.^{45,48,50}

The Californian Adventist Study and this study have similar sample characteristics. They follow the same religious practices opposed to the Oxford Study where the sample did not ascertain to include this prototype. Despite the sample distinctiveness of this study, similar results were obtained which reflect the Californian Adventist Study.^{11,15}

4.2.2 Validity and Reliability

4.2.2.1 Validity of dietary method

The sample selected from the population used to obtain the food profile for the FFQ differed from the sample used in this study. Similar characteristics (diverse and high-educated population) though, were observed in both samples and thus face validity was assumed.^{28,30,31,32,33,34} These characteristics were seen in the sample of this study for all the ethnic groups that participated (Asians, Africans, South Americans and Pacific Islanders).^{30,31,32,33,34}

Unfortunately, the sample was too small to conduct a separate validity study to assess the concurrent validity between the 24-hour recall and the SFFQ methods. Alternatively, the average of the two methods were used to obtain the

nutrient intake results. Nonetheless, validation of the SFFQ conducted in other randomized controlled trials supported the validation of this method.^{30,31,32,33,34}

4.2.3 Biochemical assessments

The drawback of this study was that it did not include biochemical markers of nutrient intake, which would have given a true reflection of dietary status. However, a meta-analysis of prospective studies have taken serum cholesterol levels into consideration by including these rigorous assessments.^{10,14}

4.3 FUTURE RESEARCH

Since this study did not embark on biochemical markers of nutrient intake which is a more rigorous measure, other studies should be conducted where investigators should consider studying the different kinds of vegetarian practices and the extent to which they prevent common non-communicable diseases and also determining any deficiencies which could likely accompany these dietary regimes. Furthermore, not only are there different vegetarian practices, but also different food selections within this cohort. For example, some vegetarians will eat mostly whole foods as compared to a similar cohort who predominantly consumes refined foods even though it's vegetarian fare. This could inevitably affect nutritional status, regardless of the dietary preference. Future studies should incorporate comparative studies between the two (whole food vs. refined food groups) in vegetarians to determine the impact of these aspects on vegetarian subjects and their risk of certain non-communicable diseases, especially CHD

Micronutrients should be assessed with rigorous methods, such as biochemical assessments. Especially vitamin D should be assessed because of its origination from dietary and environmental sources. Thus, one should consider the

physiological production of this vitamin when the individual is exposed to sunlight.



CHAPTER 5: CONCLUSION

5.1 CONCLUSIONS

The lack of significant data for this study limited the ability to conclusively express that vegetarianism influenced better nutritional status. Normal BMI and WC is an incredibly significant measure that illustrates good nutritional status. Despite the results in the data, adequate and affirmative consequences have emerged, from other research, which suggested that vegetarianism had a potential advantage with relevance to the treatment and prevention of non-communicable diseases, mainly CHD.^{3,14,47,48,52}

Nonetheless the results from this study showed prevalence of CHD risk factors for both dietary groups. Even though the energy intake was inadequate, the results show that the quality of consumption was cause for greater concern in both cohorts. Regardless of the mean values within the normal WHO ranges, a small percentage of the sample as observed by the categories for BMI and WC increased the risk of CHD for both dietary preferences. Lastly, both dietary groups practiced a healthy lifestyle with regards to no smoking and alcohol consumption, while physical activity was more of a concern for those who were not active.

The data for this study suggested that even though individuals followed a vegetarian diet, it did not necessarily alleviate the risk that the non-vegetarian were proven to have.

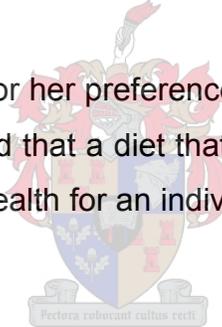
5.2 RECOMMENDATIONS

Thus from this standpoint, the intervention for vegetarians are that they follow the correct recommendations of a well-balanced diet.^{43,44,45,46,47} The paramount concern is preventing all deficiencies associated with it, it thus is essential to

have a well-balanced meal, which includes - fresh fruits, vegetables, whole grains, cereals, nuts, seeds, legumes, beans and soy bean which are rich in monounsaturated and polyunsaturated fatty acids, minerals, fiber, complex carbohydrates, antioxidant vitamin, flavanoids, folic acid and phytoestrogens - a variety of food *per se*.^{43,44,45,46,48} This was cited in other studies as well, regarding the beneficial aspects of vegetarianism.^{8,10,14,15,53,54}

Animal products should not be the major supply of the meal; alternatively, more fresh plant products should be. This will inevitably lower risk of CHD, thus the recommendation for the non-vegetarian group should be to follow the example of a more prudent diet.^{53,54} The assumption that vegetarians do not acquire sufficient essential fatty acids is an unintelligent conjecture. There are several sources supplying adequate amounts necessary for an individual.^{43,44,45,46}

Lastly, every individual has his or her preference when it comes to selecting food types, nevertheless bear in mind that a diet that favors a holistic and sustainable environment as well as better health for an individual should be the motivation for various food choices.



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APPENDICES

APPENDIX 1 RESEARCH PROTOCOL

TITLE

THE EFFECT OF DIETARY PATTERNS ON **RISK FACTORS FOR CHD**: A COMPARATIVE STUDY OF STUDENTS RESIDING AT THE ADVENTIST INTERNATIONAL INSTITUTE OF ADVANCED STUDIES (AIAS) IN THE PHILIPPINES.

RESEARCHER

Cindy AN Jenneke BNutr (Berkleys)

INTRODUCTION

A dietary pattern, which favors holistic and sustainable aspects on the nutrition ecology, should be encouraged. Health is to be maintained and preserved by the consumption of an individually optimal diet. Three models have been introduced which represent the health status of individuals regarding their dietary patterns:

- Model 1: Vegetarians prone to developing nutrient-deficiencies.
- Model 2: Vegetarians and non-vegetarians both pose risks and benefits to the health status of an individual.
- Model 3: An emerging paradigm shift where the center represents the optimal diet.

The purpose for this study is to weigh the advantages and disadvantages of two opposing dietary patterns (vegetarian and non-vegetarian) with regards to their anthropometric and dietetic data. Furthermore, the report will also help students living at AIAS to make better decisions concerning their dietary and lifestyle habits.

AIM

The nutritional status of vegetarian and non-vegetarian of diverse graduate students living in the Philippines studying at Allias will be assessed.

STUDY PLAN

Study Design - Cross-sectional analytical study

Study Population - A diversity of students at Allias; 20-50 years of age; has a stable dietary pattern; intermediate level of English literacy; willing to participate in all data collection procedures; exclusion of special populations.

Sampling: Stratified random sampling

Data collection - Anthropometric data – Body mass index (BMI), waist circumference; Dietary data – 24-hour recall, FFQ; Lifestyle data – demographic questionnaire, physical activity questionnaire, smoking questionnaire.

PILOT STUDY

A test study will be conducted to test the data collection instruments and standardize the measurements before the main study.

ANALYSIS OF DATA

Descriptive and Inferential statistics will be implemented for the basis of this study.

ETHICAL AND LEGAL ISSUES

Randomly selected individuals who have volunteered to participate will sign consent forms - containing pertinent information. I.D numbers will be assigned for subject privacy. Data collected will only be used for the rationale of this study.

Commencement will be approved by the Committee of Human Research, Faculty of Health Sciences, University of Stellenbosch.

BUDGET

Total expenses will amount to approximately \$850.

SCHEDULE

A total of 5 months will be designated for the purpose of this research study.

REPORT

The study forms part of the requirements for the Masters in Nutrition degree at the University of Stellenbosch and will be reported in a thesis.

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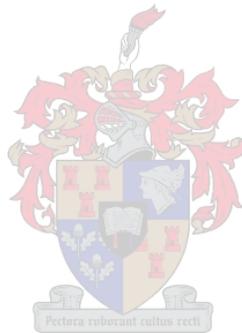
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APPENDIX 2

DIETARY SURVEY

Survey on Dietary Patterns

Researcher: Cindy Jenneke (Master in Nutrition Student at the University of Stellenbosch)

Name: _____ Apartment Number: _____

In order to classify you into the right group, (vegetarians/non-vegetarians), these questions were formulated to determine your food choices over the past year. This information will be used to select some students here at AIIAS who through their right of permission will be involved in the collection of data regarding their Nutritional Status. Incentives will be given to each person who participates in the study. Information collected will be regarded as strictly confidential at all times. The study has been approved by the Ethics Committee of the University.

Please circle the appropriate answer.

In the past year...:

1. Did you eat bread, cereal, rice and pasta?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

2. Did you eat vegetables and fruit?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

3. Did you eat meat?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

4. Did you eat poultry?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

5. Did you eat fish?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

6. Did you eat eggs?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

7. Did you eat any dairy products?

1. Yes

2. No

3. If yes, how often did you eat it: *Everyday* *3 Times per week* *Twice a month*
Once a month *Every six months* *Once a year* *Never*

8. Do you consider yourself to be a:

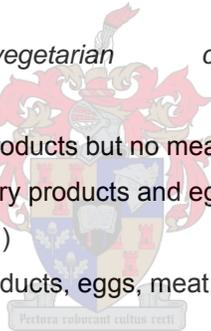
a) *Lacto vegetarian* b) *Lacto-ovo vegetarian* c) *Vegan* d) *Non-vegetarian*

a) Lacto vegetarian (Use dairy products but no meat, poultry, fish, or eggs.)

b) Lacto-ovo vegetarian (Use dairy products and eggs but no meat, poultry, or fish.)

c) Vegan (Avoid all animal foods.)

d) Non-vegetarian (Use dairy products, eggs, meat, poultry or fish.)



Comments: _____

*If you have chosen *never* for a food choice from the above questions that would determine which diet (a, b, c, or d) you are following.

Thank you for your cooperation

God bless!!!

Any questions pls. call 471

APPENDIX 3
SOCIO-DEMOGRAPHIC QUESTIONNAIRE

Socio Demographic Questionnaire

I.D NO. _____

1. How old were you on your last birthday?
Code age in years _____
Don't know/Not sure 0 7
Refused 0 9

2. What is your race? Would you say:

Please Read

- a. White 1
b. Black 2
c. Asian, Pacific Islander 3
d. Aleutian, Eskimo, or American Indian 4
or
e. Other: (specify) _____ 5
Don't know/Not sure 7
Refused 9

3. Are you of Hispanic origin such as Mexican American, Latin American, Puerto Rican, or Cuban?

- a. Yes 1
b. No 2
Don't know/Not sure 7
Refused 9

4. What is the highest grade or year of school you completed?

Read only if Necessary

- a. Eighth grade or less 1
b. Some high school 2
c. High school graduate or GED certificate 3
d. Some technical school 4
e. Technical school graduate 5
f. Some college 6
g. College graduate 7
h. Postgraduate or professional degree 8
Refused 9

5. Are you currently:

Please Read

- a. Employed for wages 1
b. Self-employed 2
c. Out of work for more than 1 year 3
d. Out of work for less than 1 year 4
e. Homemaker 5
f. Student 6
or
g. Retired 7
Refused 9

6. And are you:

Please Read

a. Married	1
b. Divorced	2
c. Widowed	3
d. Separated	4
e. Never been married	5
or	
f. A member of an unmarried couple	6
Refused	9

7. Which of the following categories best describes your annual household income from all sources?

Please Read

a. Less than \$10,000	1
b. \$10 to less than \$15,000	2
c. \$15 to less than \$20,000	3
d. \$20 to less than \$25,000	4
e. \$25 to less than \$35,000	5
f. \$35 to \$50,000	6
or	
g. Over \$50,000	7
Don't know/Not sure	8
Refused	9

8. About how much do you weigh without shoes?

a. Weight	_____
kilograms	
Don't know/Not sure	777
Refused	999

9. About how tall are you without shoes?

a. Height	____/____
centimeters	
Don't know/Not sure	777
Refused	999

10. Indicate sex of respondent.

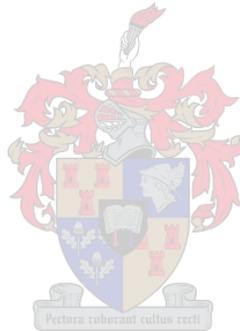
a. Male	1
b. Female	2

APPENDIX 4
ANTHROPOMETRIC DATA SHEET

Anthropometric Data

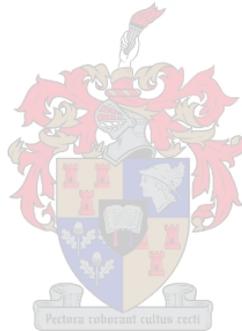
I.D NO. _____

Variables	First measurement	Second measurement	Third measurement	Average of all measurements
Weight				
Height				
BMI				
Waist circumference				

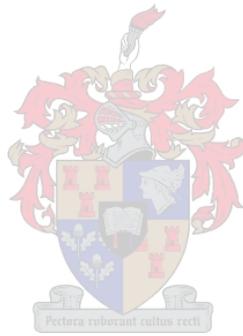


APPENDIX 5 24-HOUR RECALL

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.



APPENDIX 6
FRED HUTCHINSON SELF-ADMINISTERED FOOD FREQUENCY QUESTIONNAIRE



APPENDIX 7

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities → **Skip to question 3**

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure



Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

No moderate physical activities → **Skip to question 5**

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

No walking → **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure



This is the end of the questionnaire, thank you for participating.

APPENDIX 8

TOBACCO USE QUESTIONNAIRE

Tobacco Use Questionnaire

I.D NO. _____

1. Have you smoked at least 100 cigarettes in your entire life?

- a. Yes 1
 b. No 2
 Don't know/Not sure 7
 Refused 9

2. About how old were you when you first started smoking cigarettes fairly regularly?

- Code age in years
 Don't know/Not sure 7 7
 Refused 9 9

3. Do you smoke cigarettes now?

- a. Yes 1
 b. No **Go to Q. 6** 2
 Refused 9

4. On the average, about how many cigarettes a day do you now smoke?

- a. Number of cigarettes
 b. Don't smoke regularly 8 8
 Refused 9 9

100 cigarettes = 5 packs**1 pack = 20 cigarettes**

5. During the past 12 months, have you quit smoking for 1 day or longer?

- a. Yes 1
 b. No 2
 Don't know/Not sure 7
 Refused 9

6. About how long has it been since you last smoked cigarettes regularly? Was it:

Please Read

- a. Less than 1 month 1
 b. One month to less than 3 months 2
 c. Three months to less than 6 months 3
 d. Six months to less than 1 year 4
 e. One year to less than 5 years 5

or

- f. Five or more years ago 6
 Don't know/Not sure 7
 Refused 9

APPENDIX 9

FFQ QUALITY ASSURANCE GUIDELINES

The following should be considered before sending FFQs to NASR for processing. Note that the document Error Report provides information on quality considerations after your forms have been processed.

To Assure High-Quality Optical Scanning:

- Do not fold FFQs.
- Remove staples, paperclips and all post-it notes.
- Fill circles in completely with a dark pencil. If completed in pen, cover panned marks in dark pencil.
- FFQs must not have frayed or curled edges.
- Do not erase mistakes, instead use thin corrective tape. Contact us with any questions and see below for an example of the tape we recommend. If you are a new user, a sample of the tape will be enclosed with your first FFQ order.
- Do not use corrective fluid or white out.
- Make no marks of any kind along the bottom or sides of the form.
- Labels can be used, but must be 1 inch from any side of the booklet. Labels should be thin with no raised edges. **Please contact us before using labels.**

****To correct errors, obtain the needed information from the participant, correct erasures and/or multiple marks with corrective tape, and send corrected FFQs back to us for rescanning. Sorry, but we do have to charge for rescanning.****

Check Each Form for Completeness and Errors:

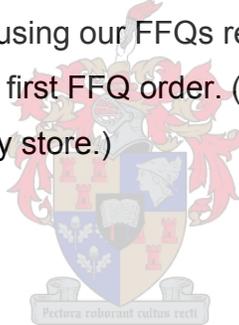
Note that FFQs are divided into three sections:

- Adjustment Questions (e.g. "Did you eat chicken or turkey...How often did you eat the skin?")
- Food Items (e.g. "How Often Did You Eat the Food...?")

- Summary Questions (e.g. "How often did you eat a serving of fruit?")
 1. Check that there are no blank pages.
 2. Check that there are no double marks where only one answer is permitted. If so, cover incorrect response with corrective tape.
 3. Check all erasures. If erasures are not complete or if there are smudge marks, use corrective tape.
 4. Check that all adjustment questions are answered.
 5. Check that all summary questions are answered.

Correction Supplies:

- We highly recommend Dryline regular or refillable Correction Film as an important tool to use for cleaning up your data so that it is complete and accurate, prior to scanning and processing (see products below).
- Each new project using our FFQs receives a Liquid Paper Correction Film dispenser with the first FFQ order. (In addition, these items may be found in any office supply store.)



APPENDIX 10

INFORMATION AND INFORMED CONSENT FORM

INFORMATION AND INFORMED CONSENT DOCUMENT

TITLE OF THE RESEARCH PROJECT:

THE EFFECTS OF DIETARY PATTERNS ON ANTHROPOMETRIC MEASUREMENTS: A COMPARISON STUDY OF STUDENTS RESIDING AT THE ADVENTIST INTERNATIONAL INSTITUTE OF ADVANCED STUDIES (AIAS) IN THE PHILIPPINES.

REFERENCE NUMBER: N04/10/170
PRINCIPAL INVESTIGATOR: CINDY JENNEKE
ADDRESS: ADVENTIST INTERNATIONAL INSTITUTE OF
 ADVANCES STUDIES (AIAS), LALAN 1, SILANG,
 CAVITE 4118, PHILIPPINES

**DECLARATION BY OR ON BEHALF OF PARTICIPANT:
 I, THE UNDERSIGNED,**.....

(Name)

ID No: the participant

A. HEREBY CONFIRM AS FOLLOWS:

1. I was invited to participate in the abovementioned research project that is being undertaken by the Department of Human Nutrition, Faculty of Health Sciences, Stellenbosch University.
2. The following aspects have been explained to me:
 - 2.1 **Aim:** The aim of the research is to objectively estimate the nutritional status. The information that will be obtained will help you to make better choices so as to prevent the primary and secondary causes of chronic diseases. This study aims to concentrate on cardiovascular disease that is one of the world's leading mortality antecedents.
 - 2.2 **Procedures:** If you choose to participate, you will be one of the participants representing the students living at AIAS who will be assessed. A set of procedures will be implemented to ascertain certain measurements regarding your nutritional status.
 - Socio-Demographic information - Date and place of birth, Age, Sex, Marital Status, Race and Level of education (10 minutes)
 - Anthropometric measurements – height, weight and waistline measurements (1 session – 10 minutes)

- Dietary measurements – 3 24-hour recalls and a food frequency questionnaire (24-HR – 20 minutes and FFQ – 20 minutes)
- Lifestyle factors – smoking and physical activity questionnaires (15 minutes)

The study duration will be one and a half months. The researcher will meet you more or less 5 times which will not consume too much of your time. If you have any further questions regarding the procedures, please direct them to the researcher involved and she will respond to your enquires.

- 2.3 **Possible benefits:** After completion of the study, you will receive the results. Advice will be given, if needs be, to make better choices for a better lifestyle. Incentives will be given after the data collection period.
- 2.4 **Confidentiality:** The information collected will be included in a thesis and probably sighted in a scientific journal. **Identity will be regarded as confidential, and disclosure of your identity will not be permitted. Therefore, an I.D number will be assigned to protect your identity.** The information will only be used for this purpose and nothing else. If your research records were to be disclosed, it will only be identified through your I.D number provided at the beginning of the study. This number will only be known by the participant.
- 2.5 **Access to findings:** Information collected from you, which will be analyzed and will be shared with you. The result of the study will also be explained to you very briefly. If you have more interest in this study, you may enquire about it from the researcher.
- 2.6 **Voluntary participation/refusal/discontinuation:** You should not feel obligated to agree to participate. Your questions should be answered clearly and to your satisfaction. Participation and discontinuation/refusal of procedures is voluntary. The researcher is allowed to withdraw the participant from the study should she feel it's in the best interest of the participant.
3. The information above was explained to me, the participant by (*Name of relevant person*) in English/Other..... and I the participant is in command of this language/it was satisfactorily translated to me by..... (*Name of translator*). I, The participant was given the opportunity to ask questions and all these questions were answered satisfactorily.
4. No pressure was exerted on me to consent to participation and I, the participant understand(s) that I may withdraw at any stage without any penalization.
5. Participation in this study will not result in any additional costs to myself, the participant.

B. HEREBY CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT/ *THAT THE PATIENT/ *POTENTIAL PARTICIPANT MAY PARTICIPATE IN THE ABOVEMENTIONED STUDY.

Signed/confirmed at on20

(Place)

(Date)

.....

.....

.....
Signature or right thumb print of participant

Signature of witness

STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S):

I,, declare that

- I explained the information given in this document to (Name of the participant)
- he/she was encouraged and given ample time to ask me any questions;
- this conversation was conducted in English /Other and no translator was used/this conversation was translated into (Language) by (Name).

Signed at

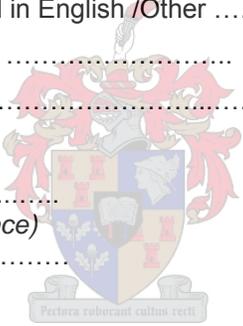
(Place)

on20

(Date)

.....
Signature of investigator

.....
Signature of witness



IMPORTANT MESSAGE TO PARTICIPANT:

Dear participant,

Thank you for your participation in this study. Should, at any time during the study,

- an emergency arise as a result of the research, or
- you require any further information with regard to the study, or
- the following occur (Indicate any circumstances which should be reported to the investigator) kindly contact(name) at telephone number

THANK YOU

APPENDIX 11
TABULATION OF DIETARY VARIABLES FOR THREE DIETARY PREFERENCES
BY GENDER

Table 11.1: The mean [SD] and confidence intervals of daily energy and nutrient intakes of subjects included in the study by dietary practices and gender.

Dietary variables	Males (n = 41)		Females (n = 29)	
	24-Hour recall (n = 64) Mean (SD) [95%]	FFQ (n = 70) Mean (SD) [95%]	24-Hour recall (n = 64) Mean (SD) [95%]	FFQ (n = 70) Mean (SD) [95%]
Energy (cal)	(p = 0.2)			
Non-vegetarian(n = 37)	1961.4 (142.1) [1677.4-2245.5]	1375.8 (139.5) [1096.9-1654.7]	1617.4 (182.2) [1253.4-1981.5]	1405 (178.9) [1047.6-1762.5]
Semi-vegetarian(n = 15)	1967.1 (227.2) [1513.1-2421.2]	1628.4 (223.1) [1182.6-2074.2]	2004.9 (278.4) [1448.8-2561.1]	1145.9 (273.3) [599.9-1691.9]
Lacto-ovo vegetarian(n = 18)	1772.6 (227.2) [1318.5-2226.6]	1328.1 (223.1) [882.3-1773.9]	2105.7 (227.2) [1651.6-2559.7]	1550.4 (223.1) [1104.7-1996.7]
Protein (g)	(p = 0.3)			
Non-vegetarian(n = 37)	73.8 (6.9) [59.9-87.6]	50.9 (5.4) [40-61.9]	52.5 (8.9) [34.7-70.3]	48.2 (7) [34.2-62.3]
Semi-vegetarian(n = 15)	58 (11.1) [35.7-80.2]	55.2 (8.7) [37.7-72.7]	60.8 (13.6) [33.6-87.9]	42.8 (10.7) [21.3-64.2]
Lacto-ovo vegetarian(n = 18)	44.8 (11.1) [22.6-67]	43.7 (8.7) [26.2-61.2]	58.5 (11.1) [36.3-80.7]	51.4 (11.1) [33.9-68.9]
Carbohydrate (g)	(p = 0.3)			
Non-vegetarian(n = 37)	281.1 (20.3) [240.5-321.8]	205.6 (19.9) [165.8-245.5]	243.9 (26) [191.8-296]	210.9 (25.5) [159.9-261.9]
Semi-vegetarian(n = 15)	310.6 (32.5) [245.5-375.5]	256.5 (31.8) [192.9-320.1]	301.6 (39.8) [222-381.2]	177.1 (38.9) [99.2-255]
Lacto-ovo vegetarian(n = 18)	283.7 (32.5) [218.7-348.7]	221.4 (31.8) [157.8-285]	308.1 (32.5) [243.2-373.1]	252.2 (31.8) [188.6-315.8]
Fat (g)	(p = 0.1)			
Non-vegetarian(n = 37)	55.8 (6) [43.6-67.9]	42.2 (5.5) [31-53.4]	43.7 (7.7) [28.2-59.3]	45.5 (7.1) [31.2-59.9]
Semi-vegetarian(n = 15)	54 (9.7) [34.6-73.4]	49.2 (8.9) [31.3-67.1]	58.9 (11.8) [35.1-82.7]	33.3 (10.9) [11.4-55.2]
Lacto-ovo vegetarian(n = 18)	48.4 (9.7) [29-67.9]	35.2 (8.9) [17.3-53.1]	70.9 (9.7) [51.5-90.3]	44.3 (8.9) [26.4-62.2]
Cholesterol (mg)	(p = 0.4)			
Non-vegetarian(n = 37)	221.2 (27.8) [165.5-276.9]	186.2 (23.2) [139.7-232.8]	131.4 (35.7) [60-202.8]	207.9 (29.8) [148.2-267.5]
Semi-vegetarian(n = 15)	182.9 (44.5) [93.8-271.9]	129.5 (37.2) [55.1-204]	180.3 (54.5) [71.2-289.3]	163.2 (45.6) [72-254.4]
Lacto-ovo vegetarian(n = 18)	107.8 (44.5) [18.7-196.8]	101 (37.2) [26.6-175.5]	137.7 (44.5) [48.6-226.7]	118.1 (37.2) [43.7-192.6]
Saturated fatty acids (g)	(p = 0.1)			
Non-vegetarian(n = 37)	14.5 (1.8) [10.7-18.2]	12 (1.8) [8.3-15.7]	10.7 (2.4) [5.8-15.6]	13.7 (2.3) [8.9-18.4]
Semi-vegetarian(n = 15)	10 (3) [3.9-16]	11.8 (2.9) [5.9-17.7]	11.4 (3.7) [4-18.8]	8.5 (3.6) [1.3-15.8]
Lacto-ovo vegetarian(n = 18)	12.2 (3) [6.2-18.4]	9.9 (2.9) [3.9-15.8]	18.9 (3) [12.9-25]	12.1 (2.9) [6.2-18]
Monounsaturated fatty acids (g)	(p = 0.3)			
Non-vegetarian(n = 37)	18.6 (2.3) [14-23.2]	15.4 (2.1) [11.2-19.5]	15.7 (2.9) [9.8-21.6]	16.5 (2.6) [11.2-21.9]
Semi-vegetarian(n = 15)	18.6 (3.6) [11.2-25.8]	19 (3.3) [12.4-25.7]	20.2 (4.4) [11.2-29.2]	12.7 (4) [4.6-20.8]
Lacto-ovo vegetarian(n = 18)	17.7 (3.6) [10.4-25]	12 (3.3) [5.9-19.2]	23.1 (3.6) [15.8-30.5]	15.9 (3.3) [9.2-22.5]
Polyunsaturated fatty acids (g)	(p = 0.1)			
Non-vegetarian(n = 37)	11.4 (1.6) [8.2-14.7]	10.3 (1.4) [7.4-13.1]	8.7 (2) [4.5-12.9]	11.3 (1.8) [7.7-14.9]
Semi-vegetarian(n = 15)	14.1 (2.6) [8.9-19.3]	12.4 (2.2) [7.9-16.9]	15.1 (3.1) [8.6-21.4]	8.7 (2) [3.1-14.2]
Lacto-ovo vegetarian(n = 18)	9.1 (2.6) [3.9-14.3]	9.7 (2.2) [5.2-14.2]	16.6 (2.6) [11.3-21.7]	11.8 (2.2) [7.3-16.3]
Fibre (g)	(p = 0.9)			
Non-vegetarian(n = 37)	16.6 (1.7) [13-20.1]	17.5 (1.7) [14.1-20.9]	14.2 (2.2) [9.7-18.7]	19.7 (2.1) [15.3-24]
Semi-vegetarian(n = 15)	17.7 (2.8) [12-23.3]	25.6 (2.7) [20.1-31]	19.3 (3.4) [12.4-26.2]	16.7 (3.3) [10-23.4]
Lacto-ovo vegetarian(n = 18)	17 (2.8) [11.3-22.6]	21.9 (2.7) [16.5-27.4]	20 (2.8) [14.4-25.7]	26.2 (2.7) [20.8-31.7]

Table 11.2: The mean [SD] and confidence intervals of micronutrient intakes of subjects included in the study by dietary practices and gender.

Dietary variables	Males (n = 41)		Females (n = 29)	
	24-Hour recall (n = 64) Mean (SD) [95%]	FFQ (n = 70) Mean (SD) [95%]	24-Hour recall (n = 64) Mean (SD) [95%]	FFQ (n = 70) Mean (SD) [95%]
Vitamin B12 (mcg)	(p = 0.9)			
Non-vegetarian(n = 37)	1.5 (0.4) [0.6-2.3]	4 (0.8) [2.4-5.7]	0.8 (0.5) [-0.2-1.8]	3.1 (1) [0.9-5.2]
Semi-vegetarian(n = 15)	1 (0.6) [-0.2-2.4]	3.6 (1.3) [1-6.3]	1.2 (0.8) [-0.4-2.7]	3.6 (1.6) [0.3-6.8]
Lacto-ovo vegetarian(n = 18)	0.9 (0.6) [-0.3-2.2]	1.6 (1.3) [-1-4.2]	0.7 (0.6) [-0.5-2.1]	1.6 (1.3) [-0.9-4.3]
Vitamin D (mcg)	(p = 0.9)			
Non-vegetarian(n = 37)	-	3.3 (0.6) [2-4.6]	-	3.1 (0.8) [1.4-4.8]
Semi-vegetarian(n = 15)	-	2.6 (1) [0.5-4.7]	-	1.9 (1.2) [-0.5-4.5]
Lacto-ovo vegetarian(n = 18)	-	2.1 (1) [0-4.2]	-	2.1 (1) [0-4.2]
Calcium (mg)	(p = 0.4)			
Non-vegetarian(n = 37)	546.9 (47.7) [451.5-642.3]	570.1 (74.3) [421.5-718.7]	479.2 (61.1) [356.9-601.4]	609.3 (95.3) [418.9-799.8]
Semi-vegetarian(n = 15)	520 (76.3) [367.5-672.4]	585.9 (118.8) [319.2-794.3]	509.2 (93.4) [322.4-695.8]	373.7 (145.6) [82.8-664.6]
Lacto-ovo vegetarian(n = 18)	658.9 (76.3) [506.4-811.3]	556.7 (118.8) [319.2-794.3]	767.8 (76.3) [615.3-920.2]	687.3 (118.8) [449.8-924.8]
Iron (mg)	(p = 0.3)			
Non-vegetarian(n = 37)	12 (0.8) [10.2-13.8]	12.6 (1.1) [10.2-14.8]	9.7 (1.1) [7.4-11.9]	11.3 (1.4) [8.3-14.2]
Semi-vegetarian(n = 15)	10.1 (1.4) [7.3-13]	15.4 (1.8) [11.8-19.1]	10.8 (1.7) [7.3-14.3]	10.7 (2.2) [6.2-15.2]
Lacto-ovo vegetarian(n = 18)	10.5 (1.4) [7.6-13.4]	13.3 (1.8) [9.7-17.1]	11.8 (1.4) [8.9-14.6]	14.9 (1.8) [11.2-18.5]
Zinc (mg)	(p = 0.7)			
Non-vegetarian(n = 37)	4.4 (0.4) [3.5-5.4]	8.5 (1) [6.3-10.8]	3.6 (0.6) [2.4-4.9]	6.9 (1.4) [4.1-9.7]
Semi-vegetarian(n = 15)	2.6 (0.7) [1.1-4.2]	9.9 (1.7) [6.3-13.3]	4.1 (0.9) [2.2-5.9]	7.8 (2.1) [3.6-12.1]
Lacto-ovo vegetarian(n = 18)	4.5 (0.7) [2.9-6]	7 (1.7) [3.5-10.5]	5.4 (0.7) [3.9-7]	7.9 (1.7) [4.4-11.3]

APPENDIX 12

E-MAIL CORRESPONDENCE REGARDING THE SAMPLE SIZE

-----Original Message-----

From: Cindy Jenneke [mailto:c_jenneke@hotmail.com]
 Sent: Monday, April 04, 2005 9:48 AM
 To: Nel Daan <dgnel@sun.ac.za>
 Cc: Herselman Marietjie, Prof <mgh@sun.ac.za>; Labadarios Demetre, Prof <demetre@sun.ac.za>
 Subject: Dear Professor Nel

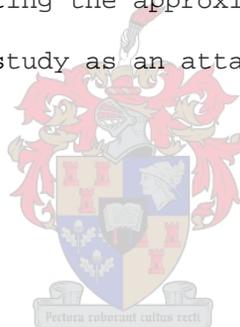
Dear Professor Nel

I'm Cindy Jenneke, student number 13868896, a current student at the University of Stellenbosch. This is my first time to correspond with you.

I'm e-mailing you concerning my research study for the Masters in Nutrition program. I would like your guidance on the approximate number for my study sample. The sampling frame consists of about 200 subjects. I would also like to know would 10 subjects be ok for my pilot study. And then for the main study, how do I go about getting the approximate number for the sample.

I have sent a summary of my study as an attachment.

Have a nice day.
 Regards,
 Cindy Jenneke



RESPONSE:

Dear Ms. Jenneke

Thank you for your e-mail.

The appropriate sample size for your study will depend on the precision you wish to use in your analyses. Usually the precision of estimating a proportion in your study is used as a benchmark for estimating the sample size.

EXAMPLE: If a proportion need be estimated with say a 95% confidence interval, then you are interested in how close the estimated proportion should be to the true proportion. This closeness is called the precision and is denoted in the accompanying sheet as C_p .

HYPOTHETICALLY SPEAKING: If you have infinitely many candidates available then a C_p of 3% (meaning that your estimate will be within 3% of the true proportion, will need a sample of size 1068! If you have only 1000 possible persons available in the population then the sample size will be 517.

There is no fixed precision that you have to use. You should just be aware that for a random sample if size 200 (from infinitely many) the precision is about 6.94% meaning that you will most likely not be closer than 6.94% for any estimate of a proportion with a 95% confidence interval. You have to decide if that precision is OK for you.

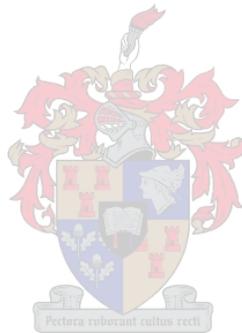
A pilot study of 10 subjects should be OK since the idea of a pilot study is merely to check your questionnaire and to iron out difficulties respondents may have with the questionnaire before proceeding to your full sample.

Kindly fill out the accompanying CSC form and e-mail it to me for our records. You need not sign it, but kindly fill in your name at "signature".

I am also sending you information about the centre for Statistical Consultation at Stellenbosch University.

Prof. D.G.Nel
Centre for Statistical Consultation
Stellenbosch University
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APPENDIX 13
ESTIMATED ENERGY REQUIREMENTS FOR MEN AND WOMEN

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

